AD-A143 588 HYDROGRAPHIC MEASUREMENTS IN THE WESTERN ARLBORAN SEA OCTOBER 1982(U) NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY NSTL STATION MS T H KINDER ET AL. APR 84 1/2

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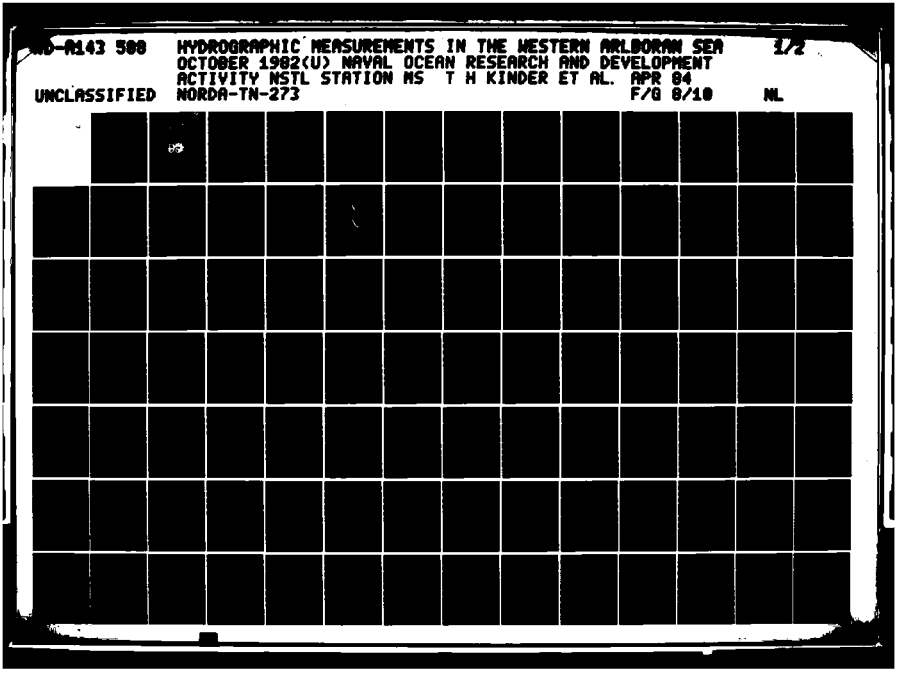

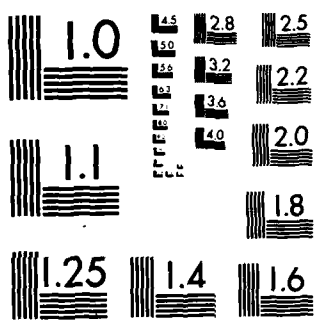

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NORDA Technical Note 273

Naval Ocean Research and
Development Activity
NSTL, Mississippi 39529

Hydrographic Measurements in the Western Alboran Sea, October 1982

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ABSTRACT

During October 1982, 78 CTD stations were taken in the Western Alboran Sea (Western Mediterranean). Vertical profiles of potential temperature, salinity, and density are presented along with potential temperature versus salinity correlation diagrams. A comparison of CTD and water sample data is presented, and the rationale for a salinity correction is given.

ACKNOWLEDGMENTS

The officers and crew of the USNS BARTLETT (T-AGOR-13), A. Rashkin, master, enthusiastically supported our work. In addition to Burns and Kinder, members of the scientific party were: Louis Banchero, Mark Bergin, Stephen Sova, Richard Myrick, Henry Perkins, Kim Saunders, Ruth Preller, and Abidi Azzouz (Centre National d'Exploitation Meteorologique, Casablanca). All contributed to these measurements. Gregorio Parrilla helped with the intercomparisons that led to the salinity correction. Code 422CS of the Office of Naval Research funded this work under Program Element 61153N.

CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

HYDROGRAPHIC MEASUREMENTS IN THE WESTERN ALBORAN SEA, OCTOBER 1982

1. INTRODUCTION

The Naval Ocean Research and Development Activity (NORDA) is studying the inflow of the Atlantic Water into the Mediterranean Sea in an Office of Naval Research funded project entitled "Mesoscale Flow Dynamics in the Strait of Gibraltar and Alboran Sea." This project has become part of an international study of the Alboran Sea/Strait of Gibraltar/Gulf of Cadiz region. This broader study has taken the name ¿Donde Va?.

The second of two ¿Donde Va? field periods occurred during October 1982 (Donde Va Group, 1984). We did 78 CTD (conductivity temperature depth profiler) stations and 152 XBT (expendable bathythermography) drops (Bergin and Kinder, 1983) during USNS BARTLETT cruise 1311-82. This note discusses the CTD data.

2. CRUISE PLAN

The plan of the cruise was to accomplish seven objectives (listed in decreasing priority):

- Recover five subsurface current meter moorings that had been deployed in June;
- Do CTD/XBT sections across the Atlantic inflow and Alboran Gyre in coordination with the Spanish ship CORNIDE DE SAAVEDRAA;
- Obtain velocity profiles across the Atlantic inflow with a tethered velocity profiler;
- Do CTD or velocity profiler time series stations;
- Obtain airsonde and other meteorological data;
- Obtain aerosol data;
- Take Secchi disc readings.

The CTD/XBT sections (Fig. 1, Tables 1-2) were designed to cross the historical position of the Atlantic inflow and the anticyclonic gyre (Cano and de Castillejo, 1972; Lanoix, 1974; Cheney and Doblar, 1982; Parrilla and Kinder, 1984). We also received infrared satellite images during October from M. Phillipe (Centre de Meteorologie Spatiale, Lannion, France) and P. E. La Violette (NORDA).

3. DATA COLLECTION AND PROCESSING

Data were acquired from a Neil Brown MK III CTD that was lowered at 60 m/min. The onboard digital recording system malfunctioned, so that data had to be recorded in analog form on the backup tape deck. This tape deck had intermittent failures in one channel that resulted in large data losses at some stations. For those stations marked "not on tape" in Table 1, we have only the shipboard printouts that were intended for preliminary data analysis only. The data for these stations were limited to about one sample every 5 m compared to one sample every few centimeters for other stations. In this report the data from the stations without a tape record are not plotted.

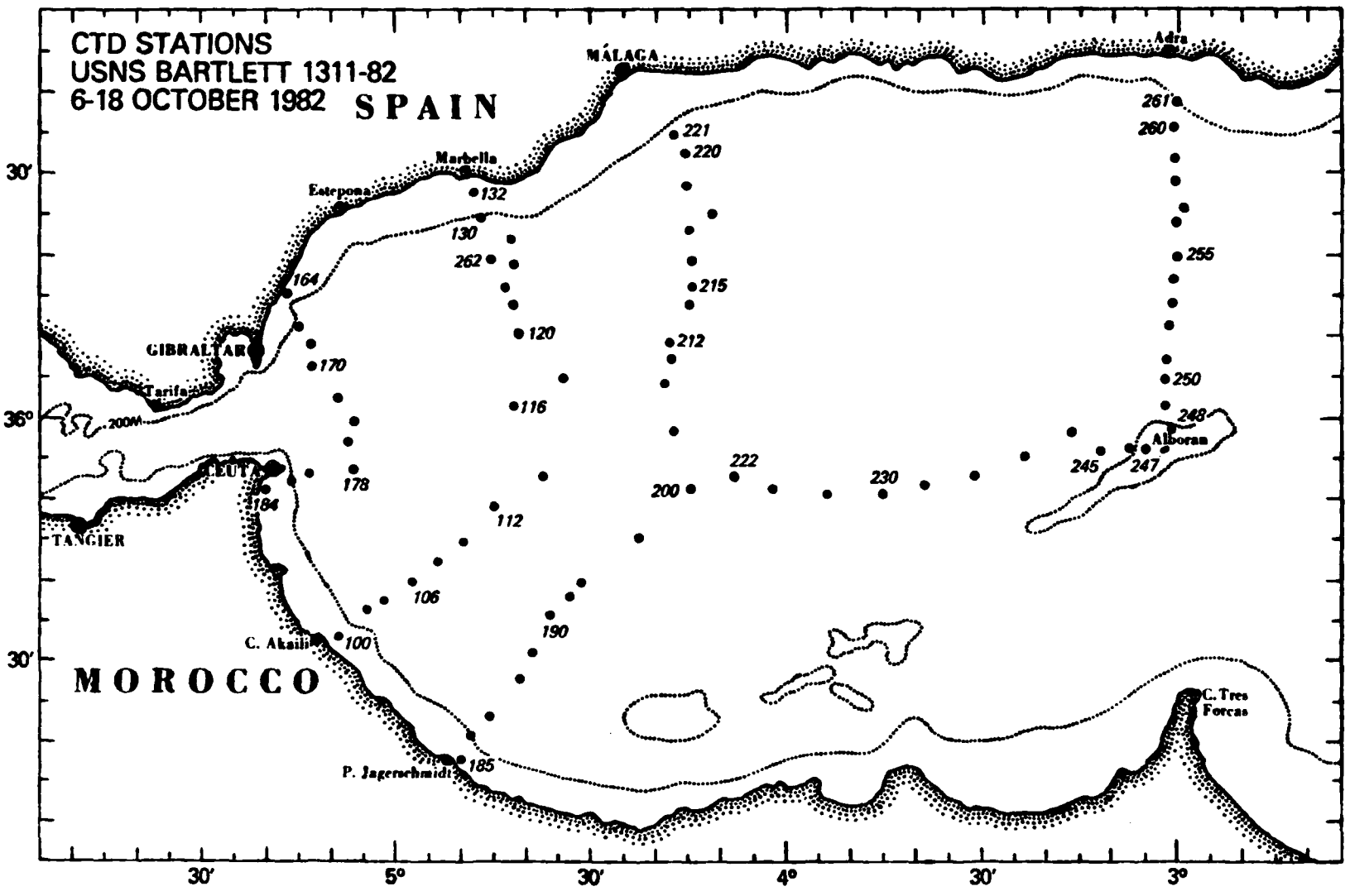

Figure 1. Cruise Track of USNS BARTLETT

TABLE 1. LIST OF STATIONS

Cast numbers appear in the form SSSCCC where SSS is a three digit number that corresponds to a geographic location (station number) and CCC is intended to be a three digit number that is consecutive throughout the cruise ("cast number"). At a time series station, only one number is assigned to the entire suite of data which may consist of many profiles (yo-yos). Anomalies:

010010 refers to both a velocity profile and XBT

SSS227 - SSS266 were skipped by mistake

DR - dead reckoning (no fix within 15 minutes)

S - satellite fix

O - Omega fix

R - radar fix

V - visual fix

CAST	TIME	JULIAN DAY	LATITUDE (N)	LONGITUDE (W)	SOURCE	DEPTH (m)	COMMENTS
100026	1513	6 OCT 279	35 32.5	5 08.3	O	80	
102028	1644	6 OCT 279	35 36.0	5 04.0	O	190	
104030	2041	6 OCT 279	35 36.9	5 02.4	O	377	
106032	2201	6 OCT 279	35 39.7	4 57.4	S	432	

108034	2359	6 OCT 279	35 42.0	4 53.7	0	506	
110036	0118	7 OCT 280	35 44.5	4 50.2	S	592	
112039	0333	7 OCT 280	35 48.1	4 45.0	0	1140	
114041	0609	7 OCT 280	35 52.4	4 36.2	S	1207	
116043	0900	7 OCT 280	36 00.8	4 41.4	0	1155	To 500 m only
118045	1001	7 OCT 280	36 04.5	4 34.2	S	1142	
120047	1232	7 OCT 280	36 10.2	4 41.4	0	996	
122050	1328	7 OCT 280	36 12.7	4 41.2	0	952	
124052	1430	7 OCT 280	36 15.8	4 42.5	S	885	
126054	1557	7 OCT 280	36 18.5	4 41.2	0	763	
128056	1713	7 OCT 280	36 21.7	4 43.4	0	476	
130058	1819	7 OCT 280	36 24.4	4 46.6	0	230	
132060	1918	7 OCT 280	36 27.2	4 47.3	0	75	
164092	0911	10 OCT 283	36 15.1	5 15.8	0	92	
166098	1024	10 OCT 283	36 11.3	5 14.9	0	302	Not on tape
168100	1123	10 OCT 283	36 08.9	5 12.4	0	639	
170102	1252	10 OCT 283	36 05.7	5 12.4	0	783	
172104	1402	10 OCT 283	36 02.8	5 09.5	0	680	
174106	1523	10 OCT 283	35 59.4	5 08.8	0	541	Not on tape
174107	1603	10 OCT 283	35 59.3	5 05.8	0	526	Not on tape
176109	1727	10 OCT 283	35 57.2	5 07.1	S	506	Not on tape
178111	1846	10 OCT 283	35 53.8	5 0.06	S	459	Not on tape

180113	2016	10 OCT 283	35 53.4	5 12.6	0	585	
182115	2111	10 OCT 283	35 52.8	5 15.6	0	441	
184117	2217	10 OCT 283	35 52.0	5 20.1	0	190	
185118	0300	11 OCT 284	35 17.0	4 50.2	0	85	
186119	0358	11 OCT 284	35 20.4	4 49.3	0	325	
187120	0459	11 OCT 284	35 23.4	4 46.2	0	375	
188121	0602	11 OCT 284	35 27.5	4 40.3	0	423	
189122	0729	11 OCT 284	35 30.4	4 39.7	0	480	
190123	0922	11 OCT 284	35 36.2	4 37.7	0	980	
191124	1133	11 OCT 284	35 37.4	4 33.8	0	1004	Not on tape
192125	1244	11 OCT 284	35 39.3	4 31.7	0	1360	
192126	1339	11 OCT 284	35 39.8	4 30.2	0	1360	Record to 20 m on upcast for remote sensing
196130	1503	11 OCT 284	35 45.0	4 21.7	0	1480	To 500 m only
200134	1637	11 OCT 284	35 50.7	4 14.9	0	1382	
204138	1930	11 OCT 284	35 58.3	4 17.8	0	1197	To 500 m only
208142	2100	11 OCT 284	36 04.0	4 18.8	0	1308	
210144	2227	11 OCT 284	36 07.6	4 17.7	0	1272	To 500 m only
212146	2333	11 OCT 284	36 10.5	4 17.6	0	1171	To 500 m only
214148	0035	12 OCT 285	36 13.5	4 15.0	0	1055	
215149	0216	12 OCT 285	36 16.2	4 14.8		502	To 500 m only
216150	0335	12 OCT 285	36 19.8	4 14.8	0	739	To 500 m only

217151	0523	12 OCT 285	36 22.9	4 15.5	0	657	
218152	0631	12 OCT 285	36 24.7	4 11.5	0	567	
219153	0738	12 OCT 285	36 28.1	4 16.2	0	434	
220154	0857	12 OCT 285	36 32.2	4 16.0	0	360	
221155	0952	12 OCT 385	36 35.6	4 17.0	S	265	
222156	1525	12 OCT 285	34 52.7	4 08.0	0	1348	To 500 m only
224158	1633	12 OCT 285	35 51.1	4 02.0	0	1074	To 500 m only
226160	1746	12 OCT 285	35 50.6	3 54.6	DR	1120	
230164	1950	12 OCT 285	35 51.2	3 45.1	0	1415	To 500 m only
234168	2135	12 OCT 285	35 51.6	3 39.6	0	1422	To 500 m only
238172	2251	12 OCT 285	35 53.4	3 31.5	0	1515	
238173	2333	12 OCT 285	35 53.0	3 31.3	0	1515	Upcast of 238172
242177	0105	13 OCT 286	35 56.2	3 24.2	0	1468	To 500 m only
244179	0236	13 OCT 286	35 57.9	3 16.4	S	1334	
245180	0443	13 OCT 286	35 55.3	3 11.8	0	659	
246181	0602	13 OCT 286	35 56.5	3 05.3	0	263	
247182	0652	13 OCT 286	35 56.5	3 04.7	0	112	
248183	0745	13 OCT 286	35 58.2	3 01.6	0	84	
249184	0835	13 OCT 286	36 01.1	3 02.8	0	980	
250185	0944	13 OCT 286	36 04.5	3 02.8	0	1621	Not on tape
250186	1005	13 OCT 286	36 04.2	3 02.7	S	1680	Repeat 250185

251187	1148	13 OCT 286	36 06.5	3 01.7	0	1603	To 500 m only Not on tape
252188	1250	13 OCT 286	36 10.5	3 01.8	0	772	Not on tape
253189	1400	13 OCT 286	36 12.9	3 02.0	S	760	To 500 m only Not on tape
254190	1507	13 OCT 286	36 16.8	3 01.7	0	857	To 500 m only Not on tape
255191	1611	13 OCT 286	36 19.8	3 00.6	0	935	To 500 m only
256192	1725	13 OCT 286	36 23.0	3 00.6	0	854	To 500 m only
257193	1833	13 OCT 286	36 25.4	2 59.6	S	805	
258194	2011	13 OCT 186	36 29.3	3 02.1	0	706	
259195	2116	13 OCT 286	36 31.5	3 01.9	0	556	
260196	2218	13 OCT 286	36 35.3	3 01.9	0	467	
261197	2302	13 OCT 286	36 37.9	3 01.3	0	232	
262501	1334	14 OCT 287	36 16.8	4 46.1	0	798	Time series. 42
262542	0340	15 OCT 288	36 18.9	4 45.8	0	700	yo-yo's. 262506 not on tape.

Table 2. Positions for Time-Series Station

Yo-Yo #	Time	Day	Latitude (N)	Longitude (W)	Depth (m)	Comments
501	1334	14 OCT 287	36-16.8	4-46.1	798	To 785 m
502	1420		36-16.9	4-45.0		
503	1440		36-17.2	4-45.2		
504	1500		36-17.5	4-45.3		
505	1520		36-17.7	4-45.3		
506	1540		36-18.2	4-45.0		Not on tape
507	1600		36-18.5	4-44.7	732	
508	1620		36-18.8	4-44.7	723	
509	1640		36-19.0	4-43.7	710	
510	1700		36-19.4	4-44.2	694	
511	1720		36-19.6	4-43.9	698	
512	1740		36-19.5	4-44.4		
513	1800		36-19.6	4-43.8		
514	1820		36-19.5	4-43.5	658	
515	1840		36-19.4	4-43.6	679	
516	1900		36-19.5	4-43.8	695	
517	1920		36-19.4	4-44.1	692	
518	1940		36-19.3	4-44.0	694	
519	2000		36-19.3	4-44.3	692	
520	2020		36-19.1	4-44.2	703	
521	2040		36-18.8	4-44.3	714	
522	2100		36-18.6	4-44.1	728	
523	2120		36-18.1	4-44.3	743	
524	2140		36-17.9	4-44.1	763	
525	2200		36-17.5	4-44.5	776	
526	2220		36-17.2	4-44.2	792	
527	2240		36-16.7	4-44.2	803	
528	2300		36-16.8	4-44.3	815	
529	2320		36-16.9	4-44.1	823	
530	2340		36-17.0	4-43.9	820	
531	0000	15 OCT 288	36-16.7	4-44.4	818	
532	0020		36-16.7	4-44.3	814	
533	0040		36-16.7	4-44.4	812	
534	0100		36-16.6	4-44.6	808	
535	0120		36-16.8	4-45.6	804	
536	0140		36-17.0	4-46.0	794	
537	0200		36-17.1	4-45.8	783	
538	0220		36-17.5	4-45.4	782	
539	0240		36-17.7	4-45.4	759	
540	0300		36-18.2	4-45.6	714	
541	0320		36-18.6	4-45.8	710	
542	0340	15 OCT 288	36-18.9	4-45.8	700	To 685 m

The analog tape data were transcribed to digital form and then edited to remove spikes. The sensor responses were matched, and then the data were pressure-sorted and filtered to produce 1-dbar averages (Hallock, 1982). Salinities were calculated using the 1978 practical salinity scale (Lewis and Perkin, 1981), potential temperature using Fofonoff (1962), and density (as sigma-theta) using UNESCO (1980) and Millero and Poisson (1981). The new salinity and density algorithms will differ from the older algorithms in the range of Mediterranean Water. The Deep Water salinities are about 0.006 lower (Lewis and Perkin, 1981), and the densities about 0.02 kg/m^3 lower (Parrilla, 1984).

Water samples obtained with a rosette sampler were used to monitor CTD performance. Two water samples were collected at the same depth at each of 10 stations (frequent rosette malfunctions reduced the number of samples collected). Water sample salinities were determined using a Guildline Salinometer, and compared to the CTD values (Table 3). The CTD was 0.008 lower than the water samples. Using the same CTD and salinometer in June (Kinder et al., 1983), we estimated that the CTD was 0.003 too low. The same salinometer and the same operator were used to check the Neil Brown CTD on the CORNIDE DE SAAVEDRAA during October, and the agreement was within 0.003. We also compared salinity cross sections from the Mediterranean Water below 500 dbar for June and October BARTLETT data and for October CORNIDE DE SAAVEDRAA data. Because of the small salinity gradients, a difference of 0.005 at 1000 dbar displaces the isohaline about 100 dbar. The intercomparison of the three data sets showed that the October Bartlett deep salinities were 0.003 to 0.008 too low. We, therefore, added a correction of 0.005 to all the BARTLETT October CTD salinities. This correction makes the three data sets more compatible below 500 dbar, and has no consequences at shallow depths because of the large salinity gradients there. Accuracies for this data are: 0.005°C, 0.005 salinity, and 5 dbar.

Because new algorithms were being implemented while these data were being processed, there are several anomalies in the plotted data:

- Potential temperature is used throughout, although sometimes labeled as "t" (e.g., sigma-t);

- Salinity was always calculated using practical salinity units, although it is labeled "ppt." Practical salinity has no units;

- Density is always represented as sigma-theta, although it is labeled as "sigma-t";

- Density in the plots was calculated using the older algorithms (Fofonoff, 1962). This is significant for the Mediterranean Water theta-S diagrams where the plotted isopycnals are about 0.02 kg/m^3 too high. Data files for this data and for the June data (Kinder et al., 1983) have been updated with the new algorithm.

Navigation was by radar and visual fixes near land, and by satellite and omega elsewhere. Station positions near land were accurate to about 0.5 km. Away from land, the combination of accurate but intermittent satellite fixes and continuous but inaccurate omega gave an estimated accuracy of about 1 km. Individual fixes based on the satellite system were accurate to about 0.5 km and on omega to about 2.0 km.

Table 3. Salinity Calibration

Station	Water Sample T(°C)		P(dbar)	CTD T(°C)		Sample - CTD
106	12.88	38.435	410	12.86	38.422	+0.013
112	13.00	38.424	1067	12.93	38.419	+0.005
114	13.03	38.442	1178	12.98	38.426	+0.016
118	13.00	38.427	1128	12.95	38.420	+0.007
124	12.96	38.400	840	12.94	38.427	-0.027*
196	13.11	38.467	500	13.12	38.465	+0.002
200	12.98	38.426	1340	12.96	38.419	+0.007
200	12.96	38.437	1196	12.96	38.422	+0.015
200	13.22	38.492	422	13.20	38.482	+0.010
200	13.23	38.429	340	13.23	38.469	-0.040*
208	13.00	38.420	1300	12.97	38.420	0
214	12.85	38.438	1000	12.96	38.428	+0.010
226	12.98	38.433	1013	12.97	38.427	+0.006

*Outliers

For all samples (n = 13): mean difference = +0.0018
standard deviation = 0.0166

For all samples less outliers (n = 11): mean difference = +0.0083
standard deviation = 0.0051

4. DISCUSSION

In addition to composite theta-S plots (Fig. 2), we have also provided four plots for each station (Figs. 3-69). Plot A is the density as sigma-theta (labeled as sigma-t), salinity, and potential temperature (theta) versus pressure for the entire cast. Plot B is the theta-salinity correlation diagram for the entire cast. Plot C is the same as plot A, but it is limited to the upper 70 dbar to illustrate details of interest to ¿Donde Va? optical and biological investigators. Plot D is the same as B, but limited to potential temperatures below 13.4°C to illustrate the properties of Mediterranean Water.

Station 200 (Fig. 36) was designated an intercalibration station with the CORNIDE DE SAAVEDRAA, and it shows the water masses normally present in the western Alboran Sea (Fig. 2). Low salinity Atlantic Water occupied the upper 100 dbar as a nearly isohaline but thermally-stratified layer (20.5°C, 36.46, 3 dbar; 15.5°C, 36.47, 103 dbar). At 72 dbar, there was a small salinity minimum (36.41) within this layer relict from the North Atlantic Central Water (Lanoix, 1974). Salinities then decreased while temperature decreased until a slight temperature minimum (about 0.015°C cooler) at 270 dbar (13.16°C, 38.41, 29.00 kg/m^3) that delineates Mediterranean Winter Water (Lanoix, 1974; Parrilla and Kinder, 1984). Below this was the Intermediate Water salinity maximum (400 dbar, 13.15°C, 38.49, 29.07 kg/m^3) that is relict of Levantine Intermediate Water (Katz, 1972; Parrilla and Kinder, 1984). Both potential temperature and salinity then decrease to the bottom where Western Mediterranean Deep Water resides (Lacombe et al., 1981; Parrilla and Kinder, 1984) (1400 dbar, 12.75°C, 38.42, 29.10 kg/m^3).

Time-series station 262 consisted of 42 casts made near the same point (Table 2 has positions) over 14 hours. The first and last cast were made close to the bottom, and the other casts were between 5 and 350 dbar. Figure 70 has five parts. Parts A, B, and C are successive vertical profiles of temperature, salinity, and density. Part D is the successive theta-salinity diagrams, and Part E is the composite theta-S diagram. The figure shows changes in both the T-S correlations and a large downward displacement of the isopycnals when a 25 m amplitude internal wave passed the station during casts 536-538.

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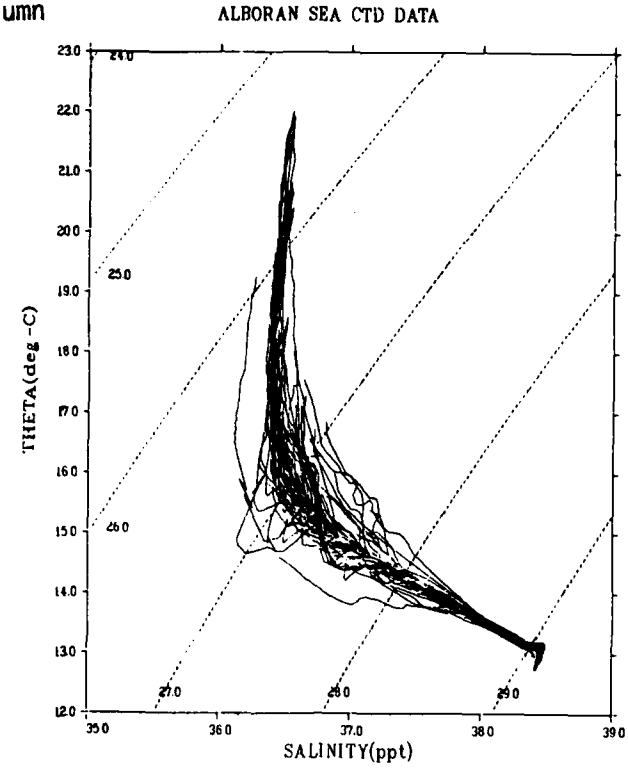
A. Entire water column



B. Mediterranean water only

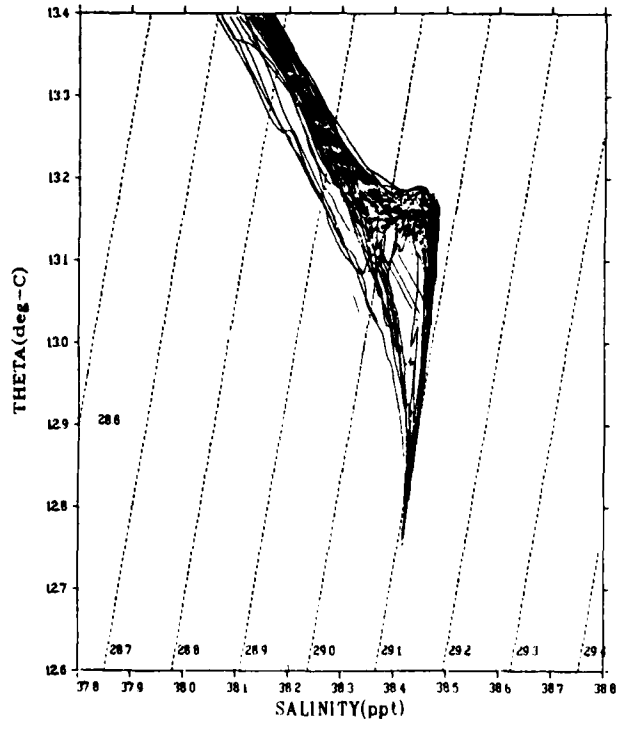


Figure 2. Composite potential temperature-salinity

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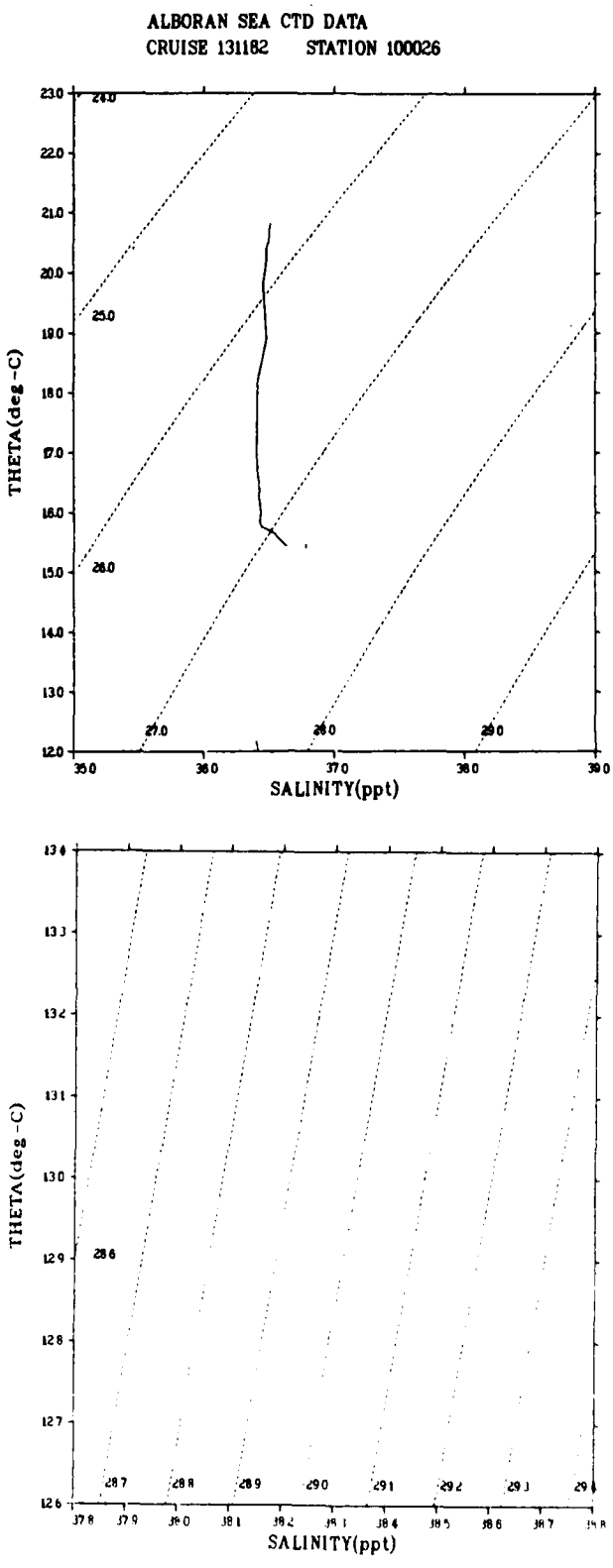
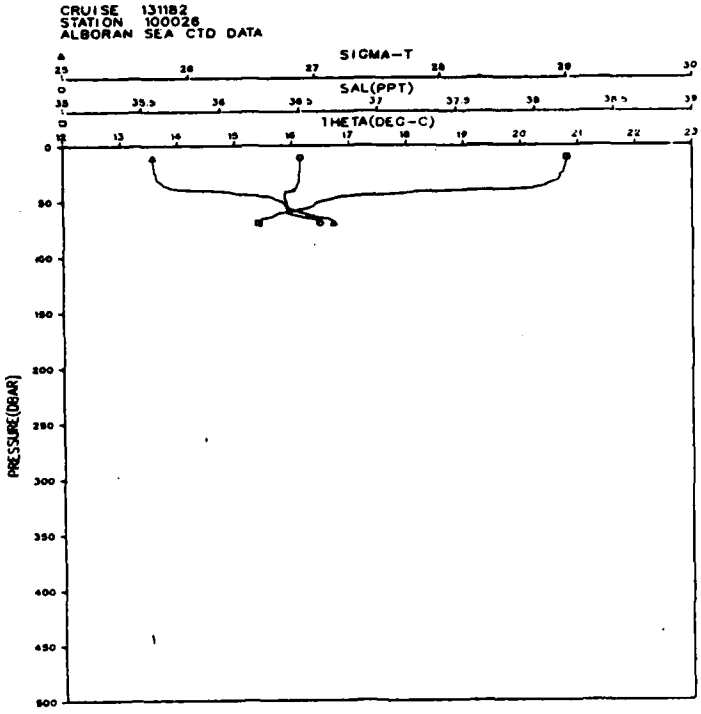
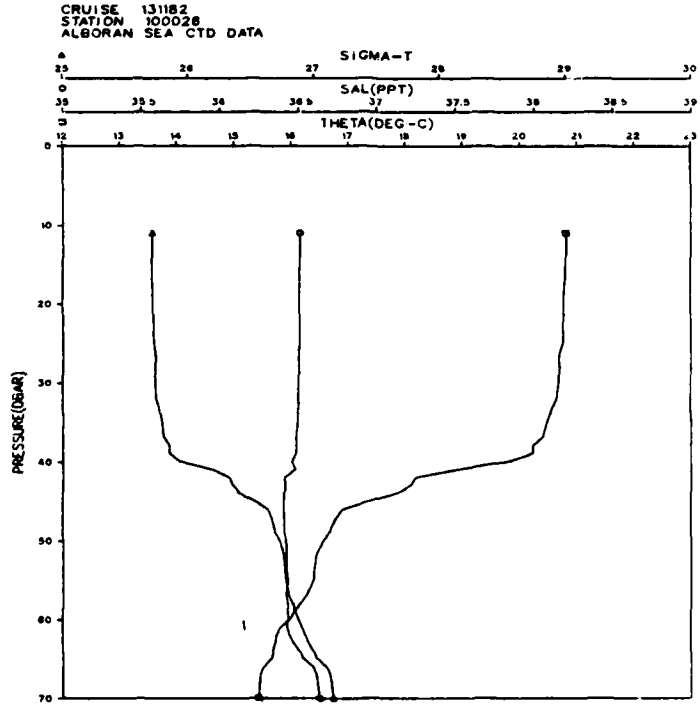
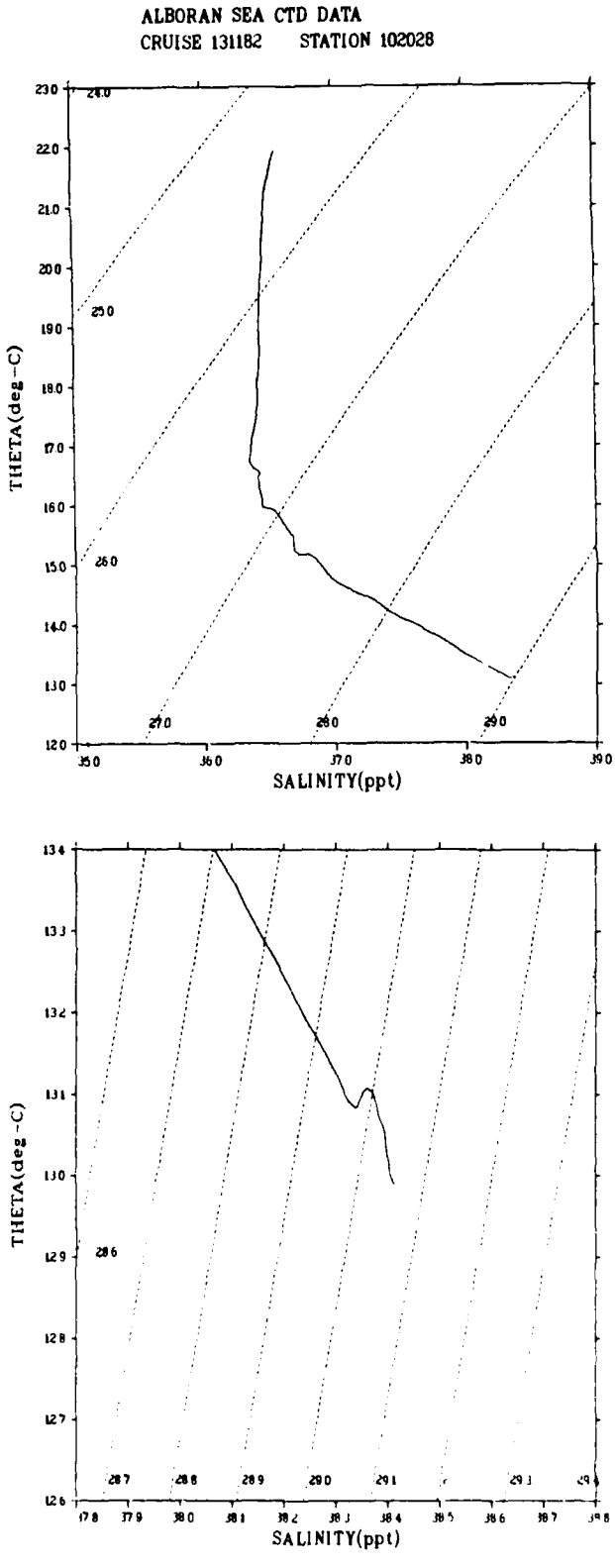


Figures 3a and 3b

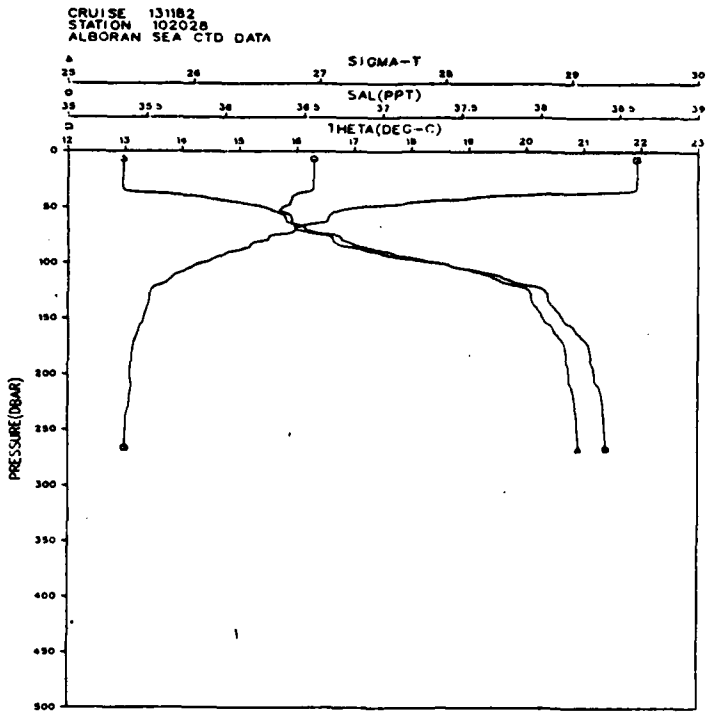


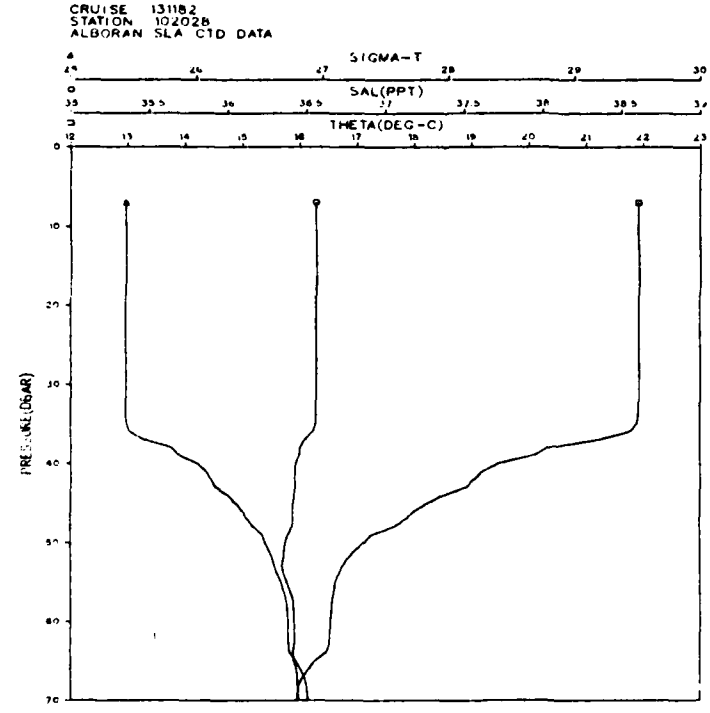


Figures 3c and 3d

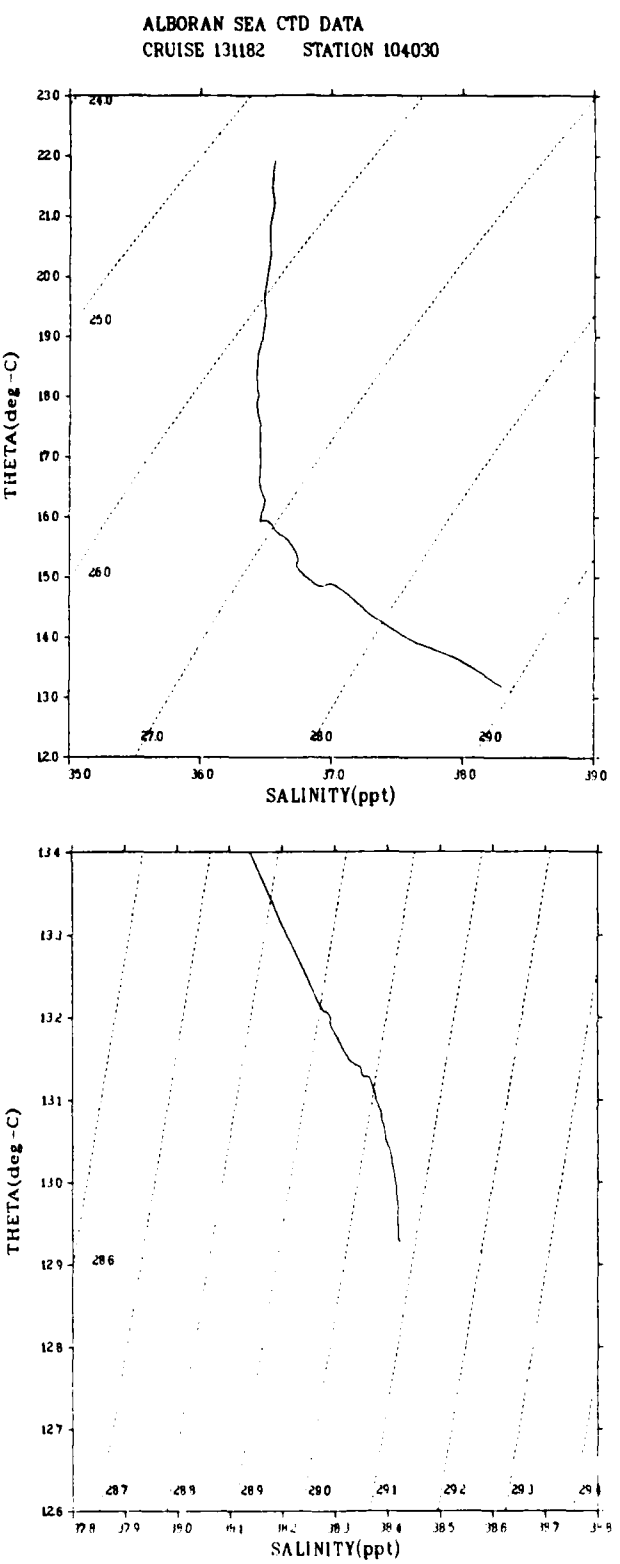


Figures 4a and 4b

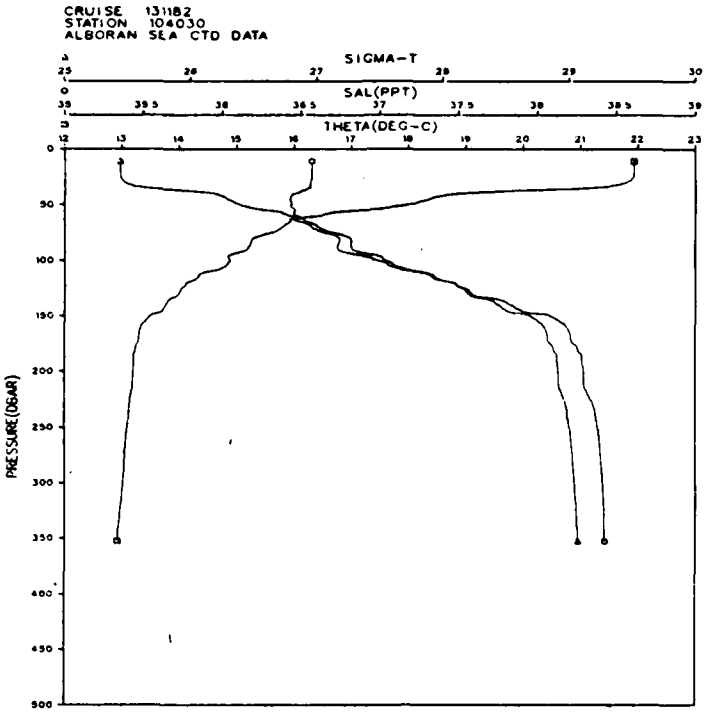


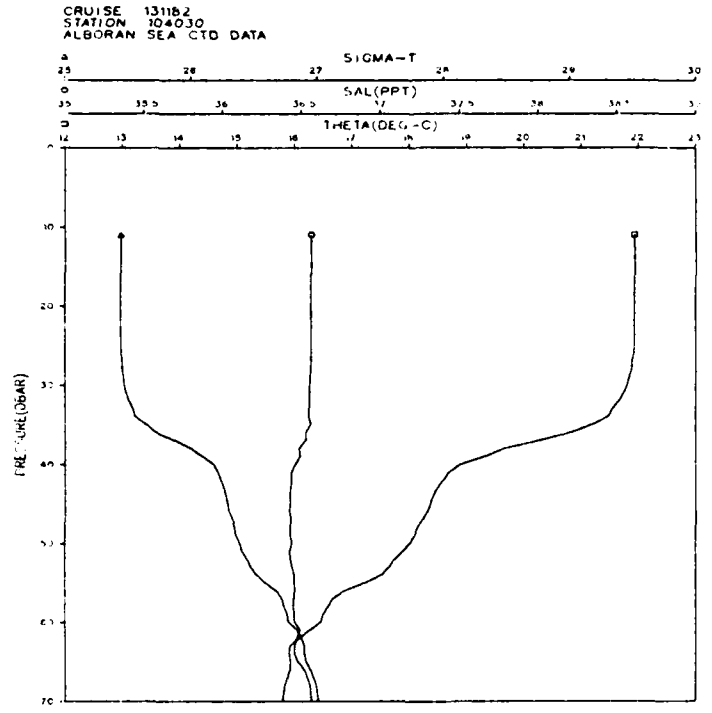


Figures 4c and 4d

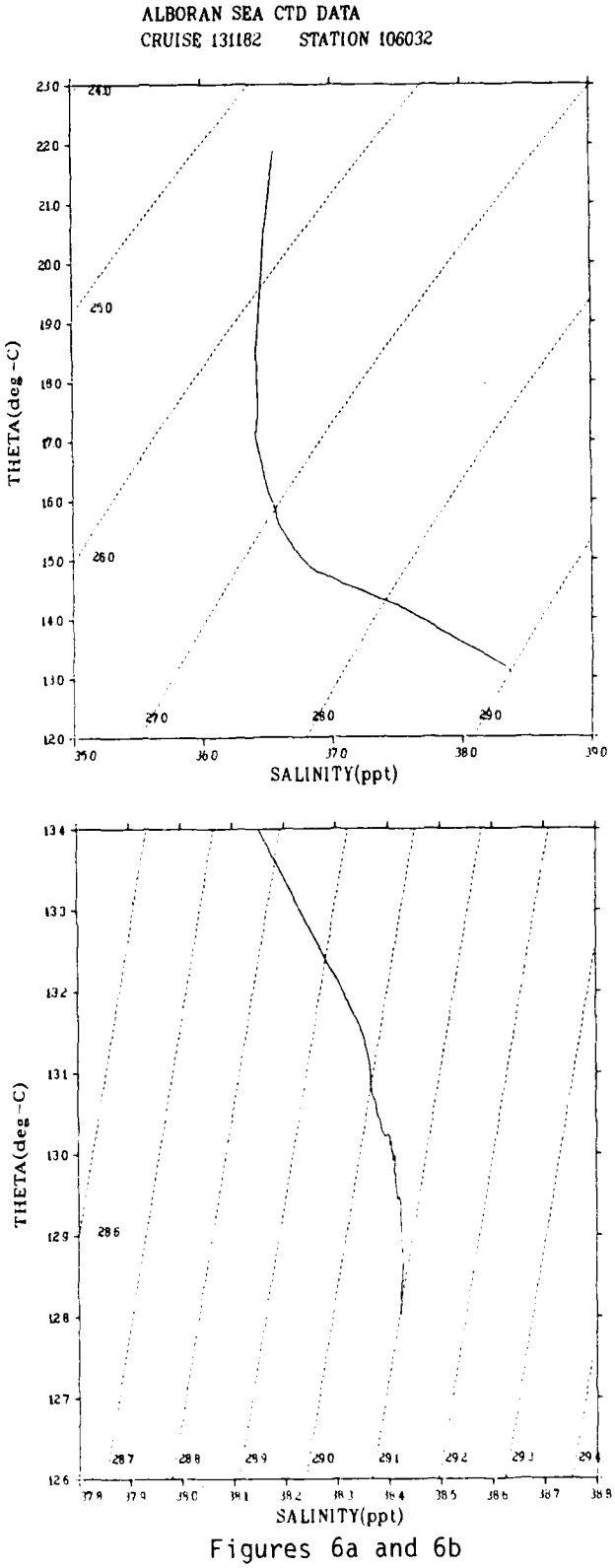


Figures 5a and 5b

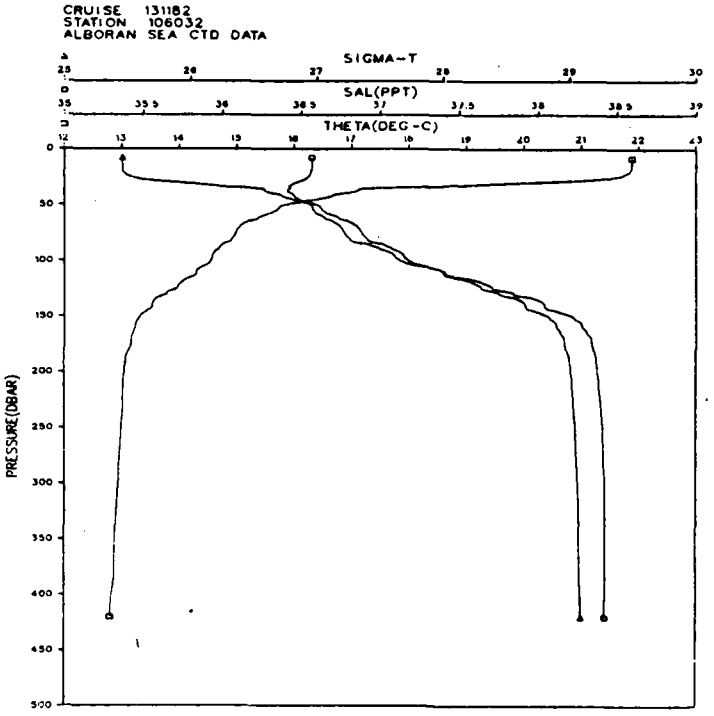


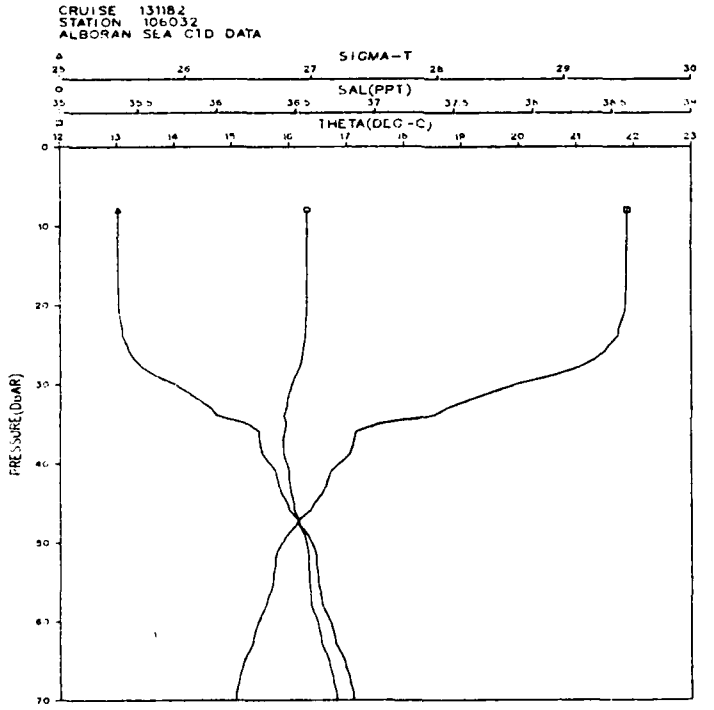


Figures 5c and 5d

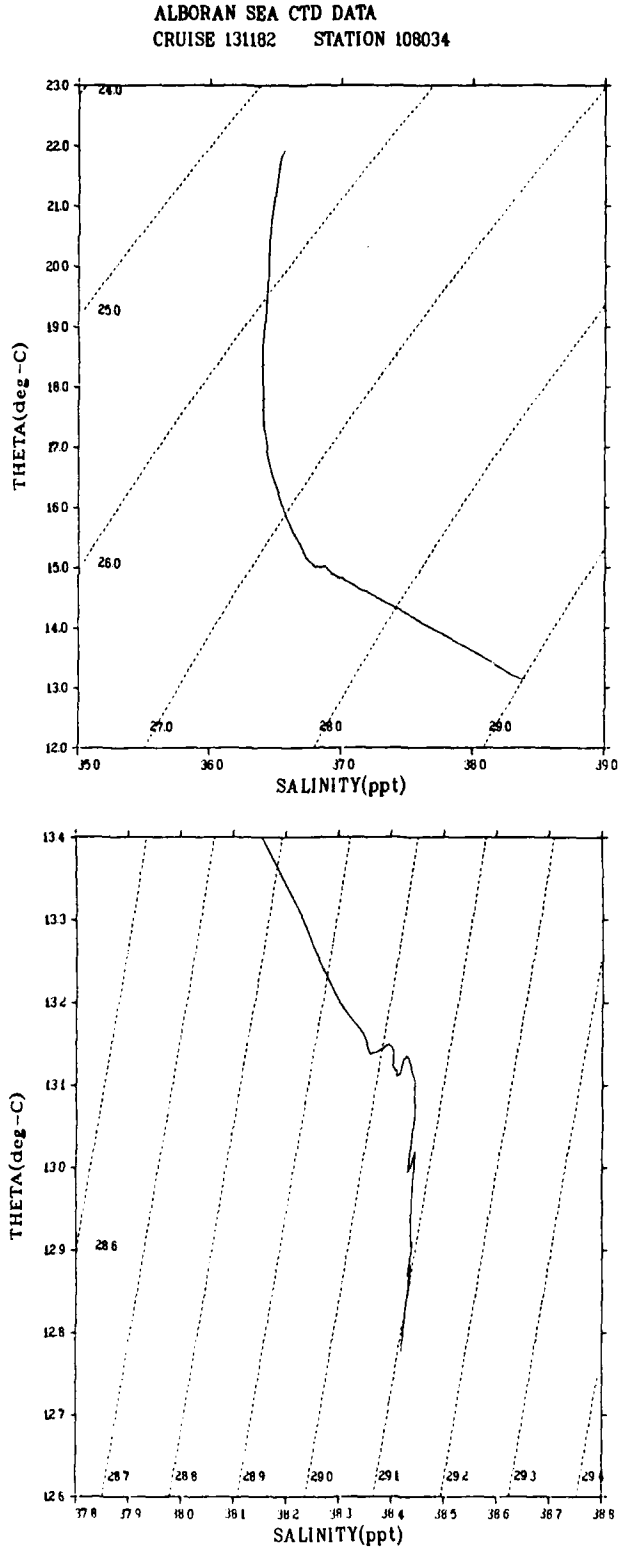


Figures 6a and 6b

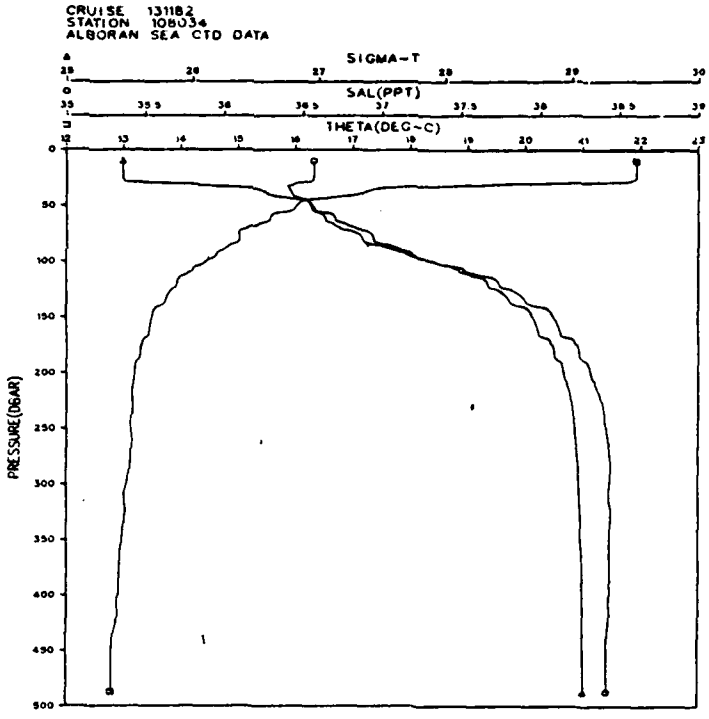


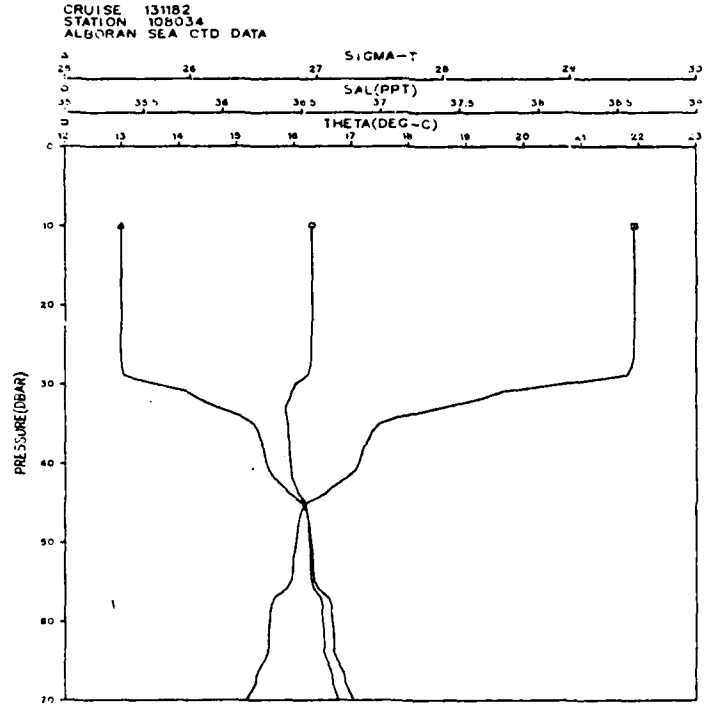


Figures 6c and 6d

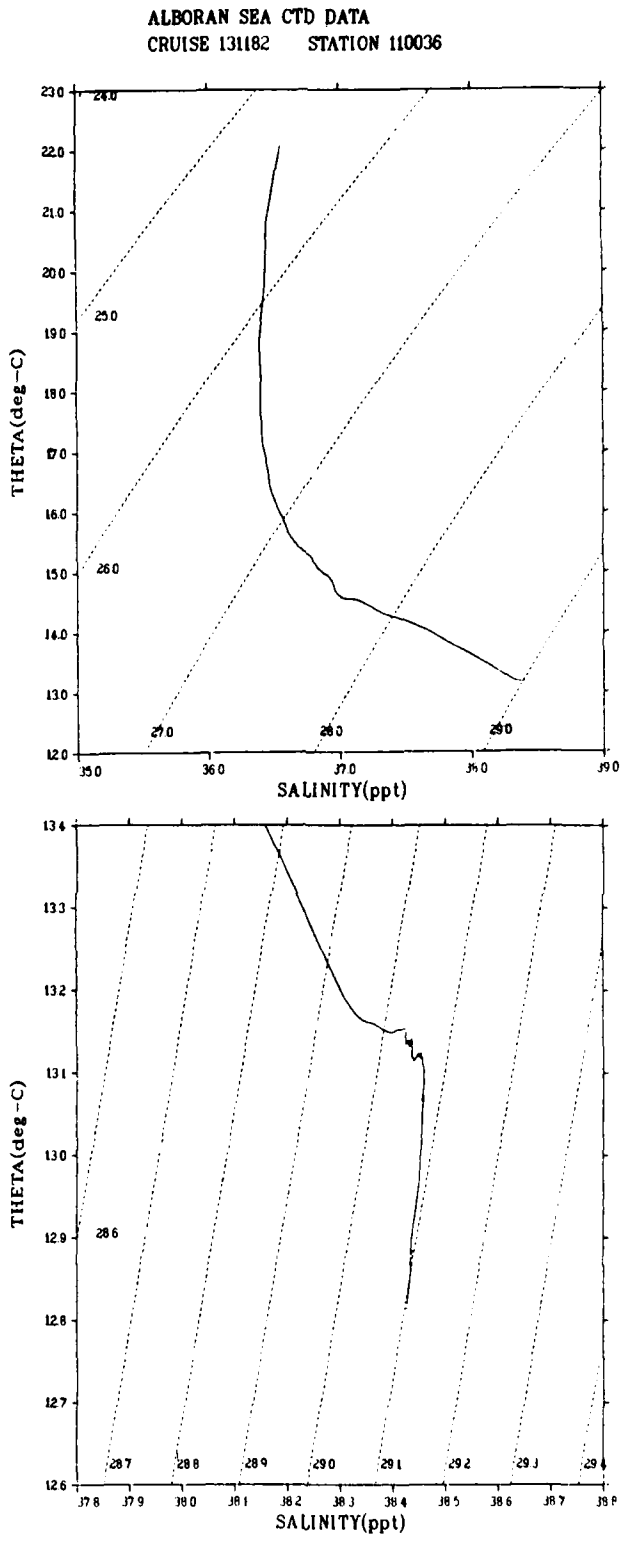


Figures 7a and 7b

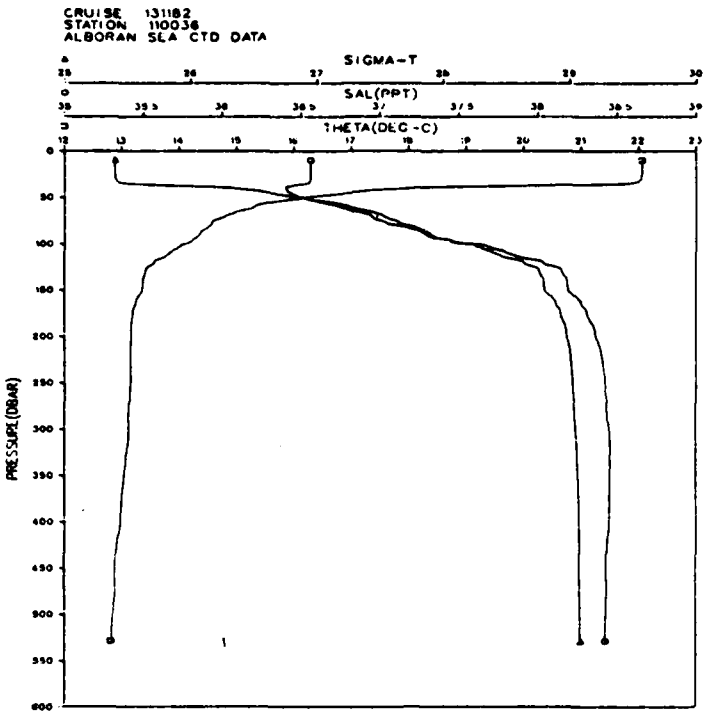


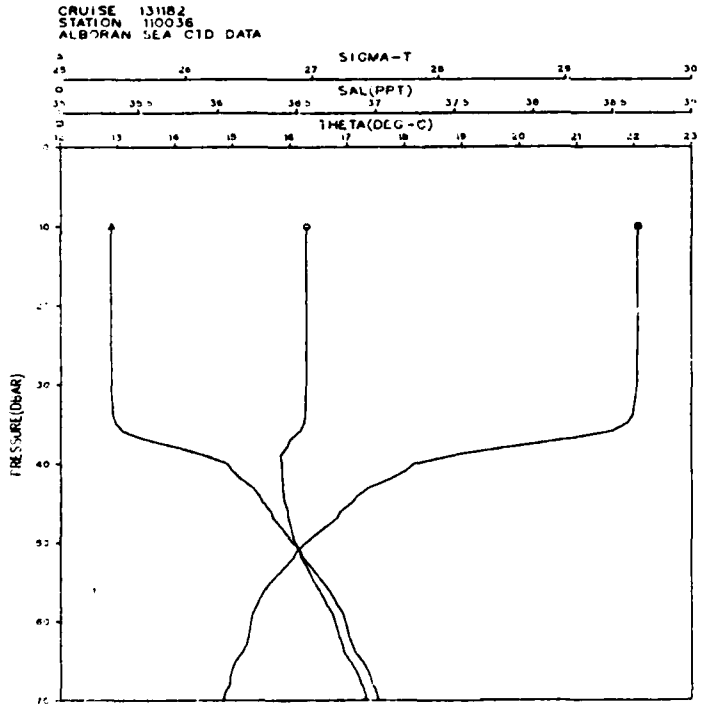


Figures 7c and 7d

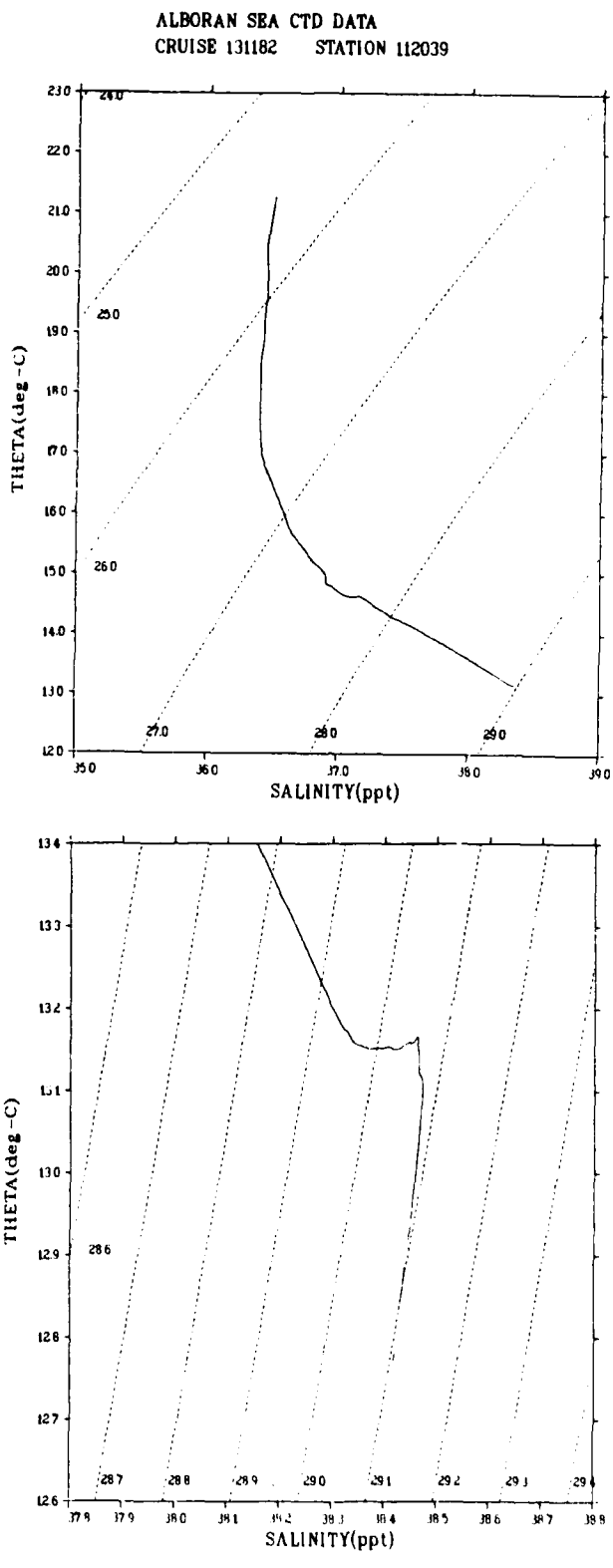


Figures 8a and 8b

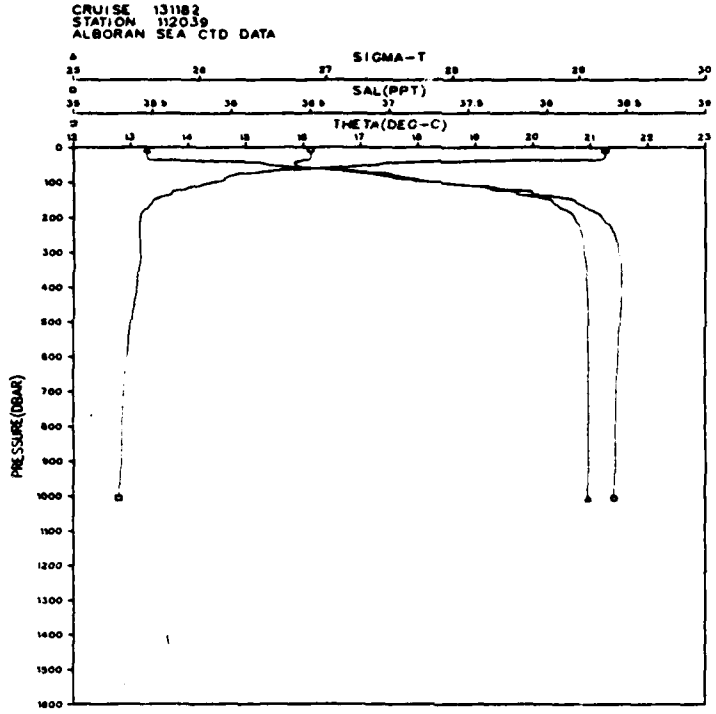


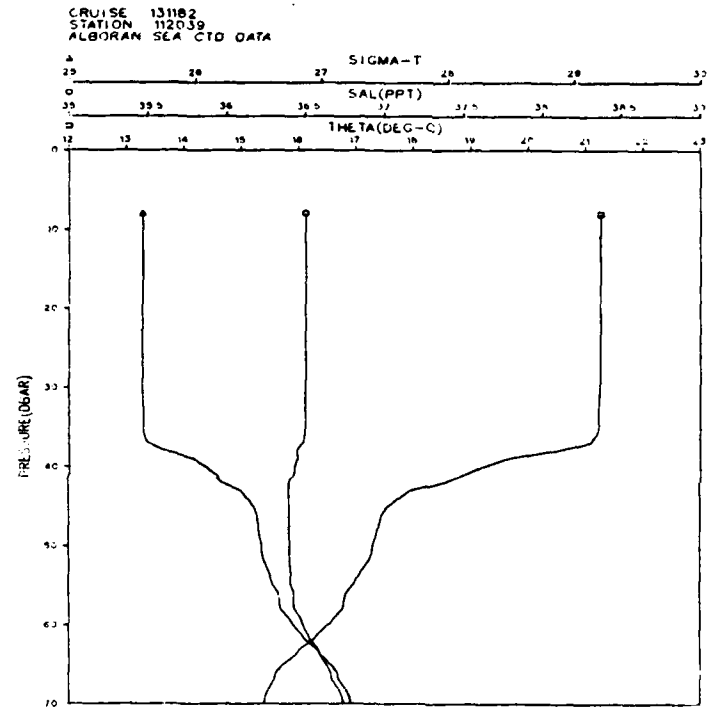


Figures 8c and 8d

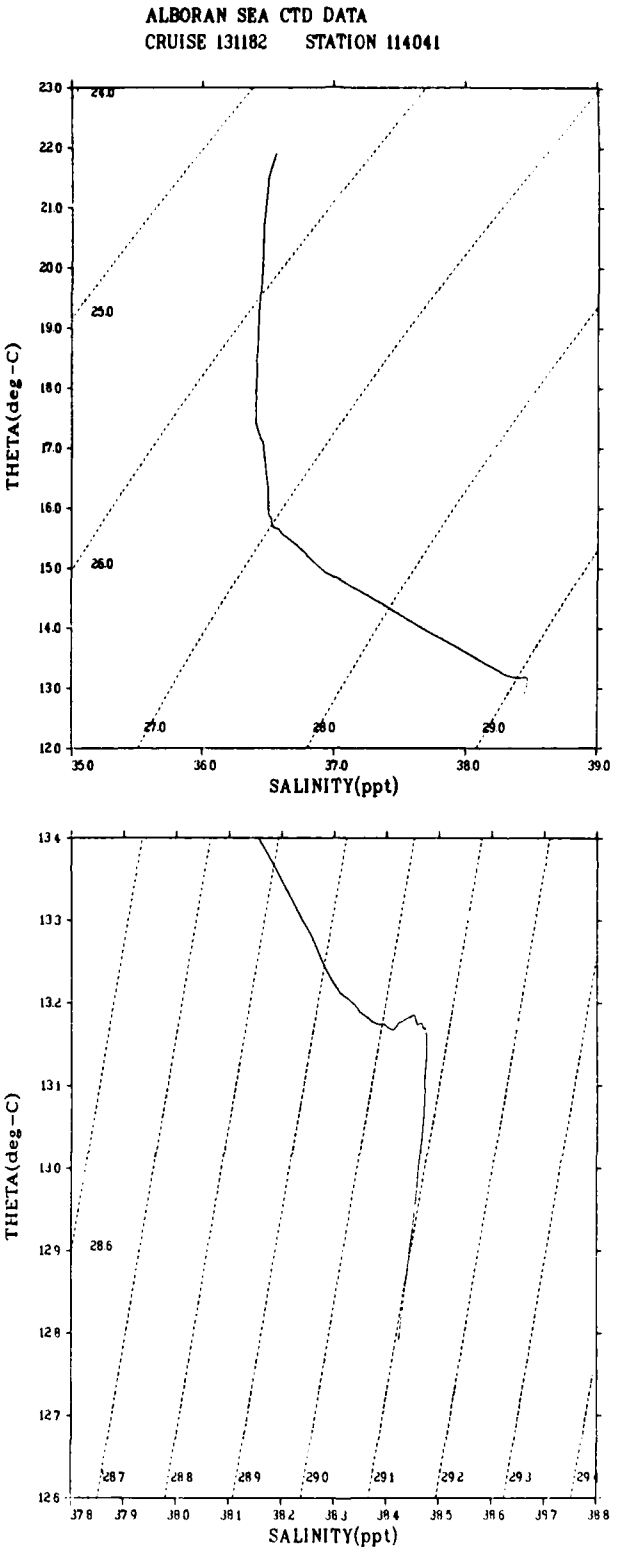


Figures 9a and 9b

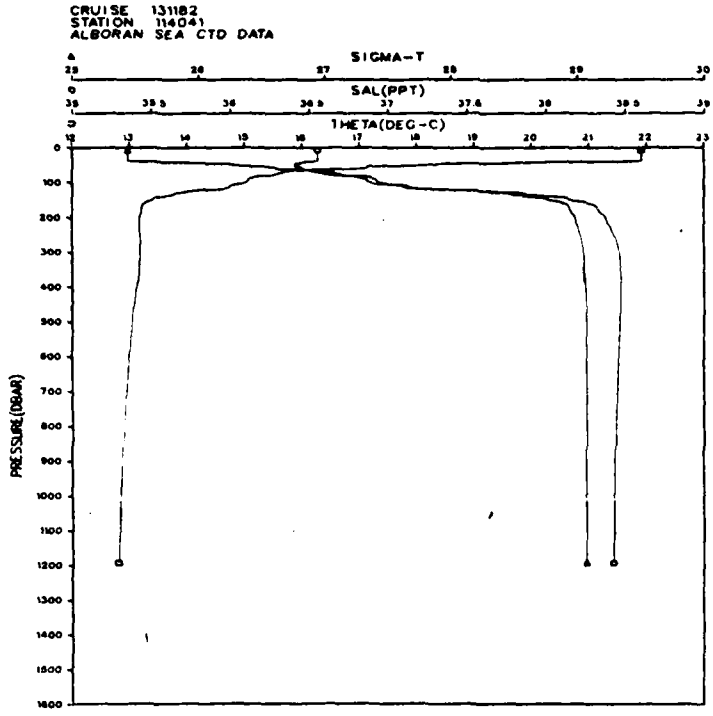


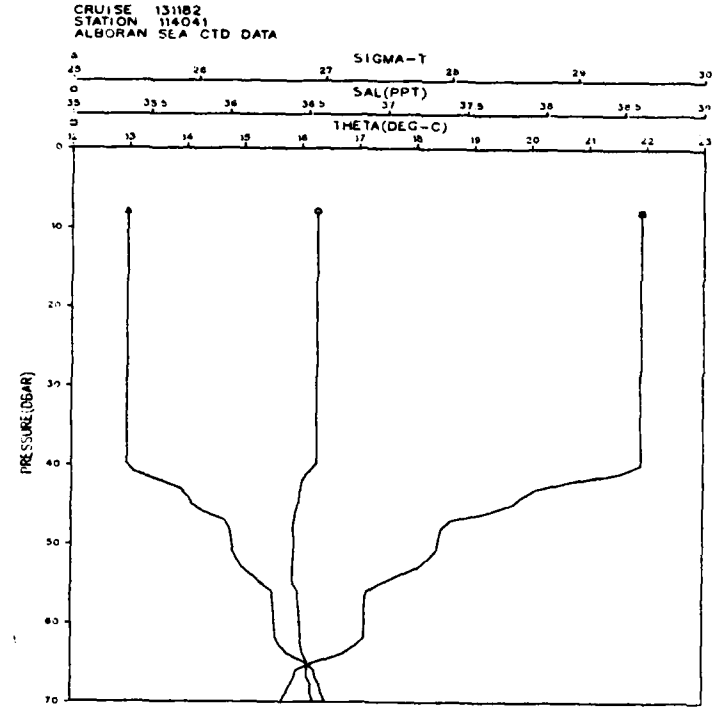


Figures 9c and 9d



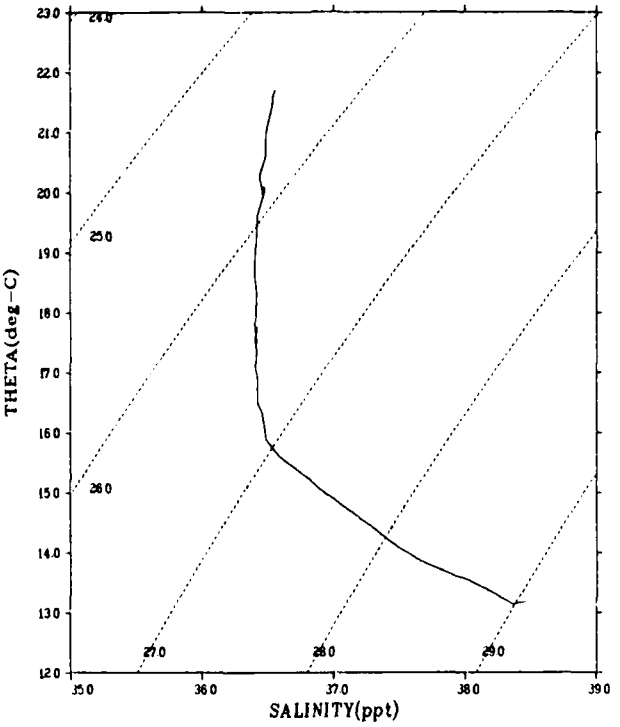
Figures 10a and 10b

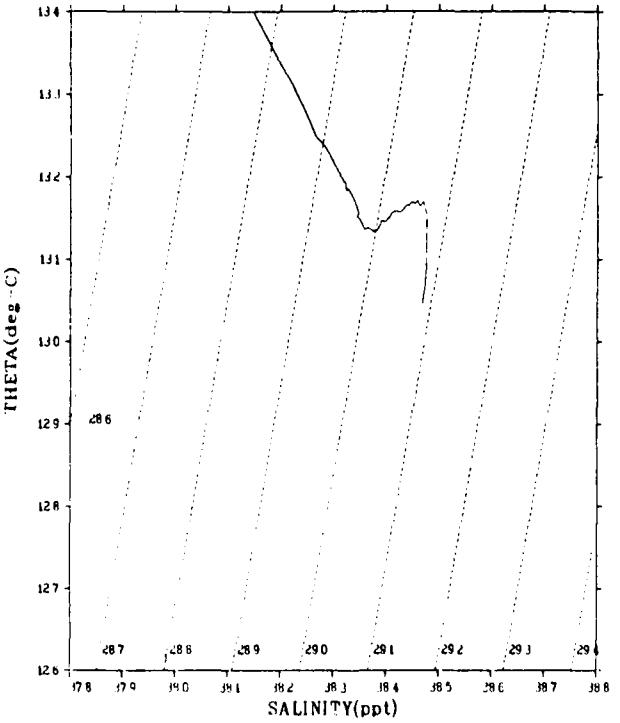




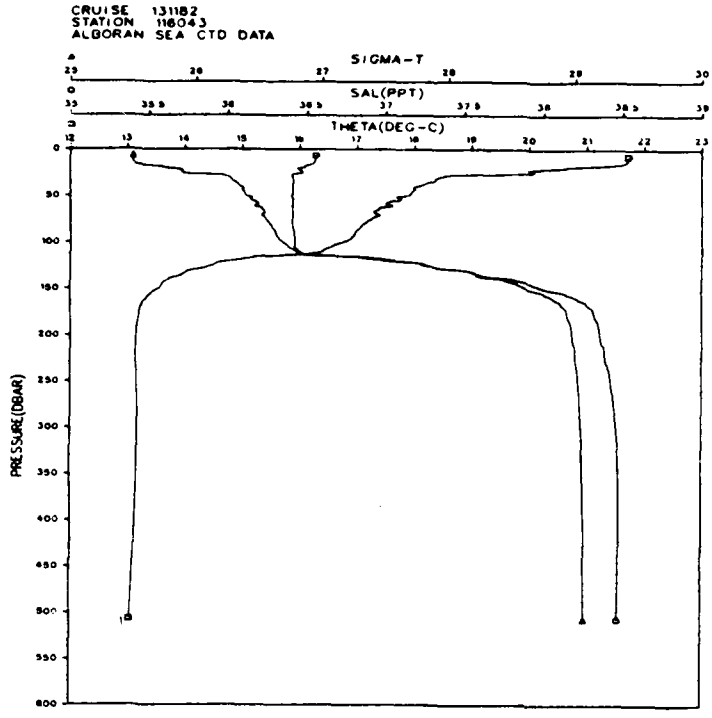
Figures 10c and 10d

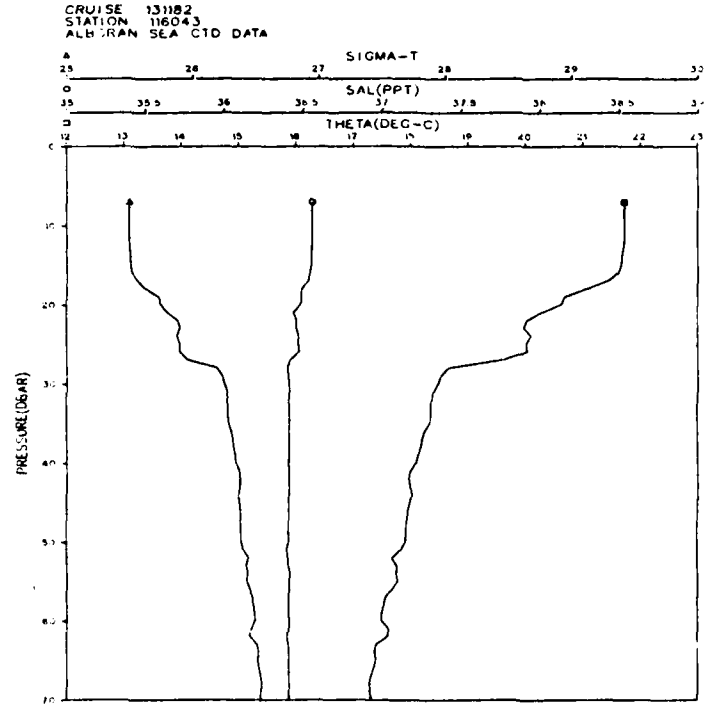
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 116043



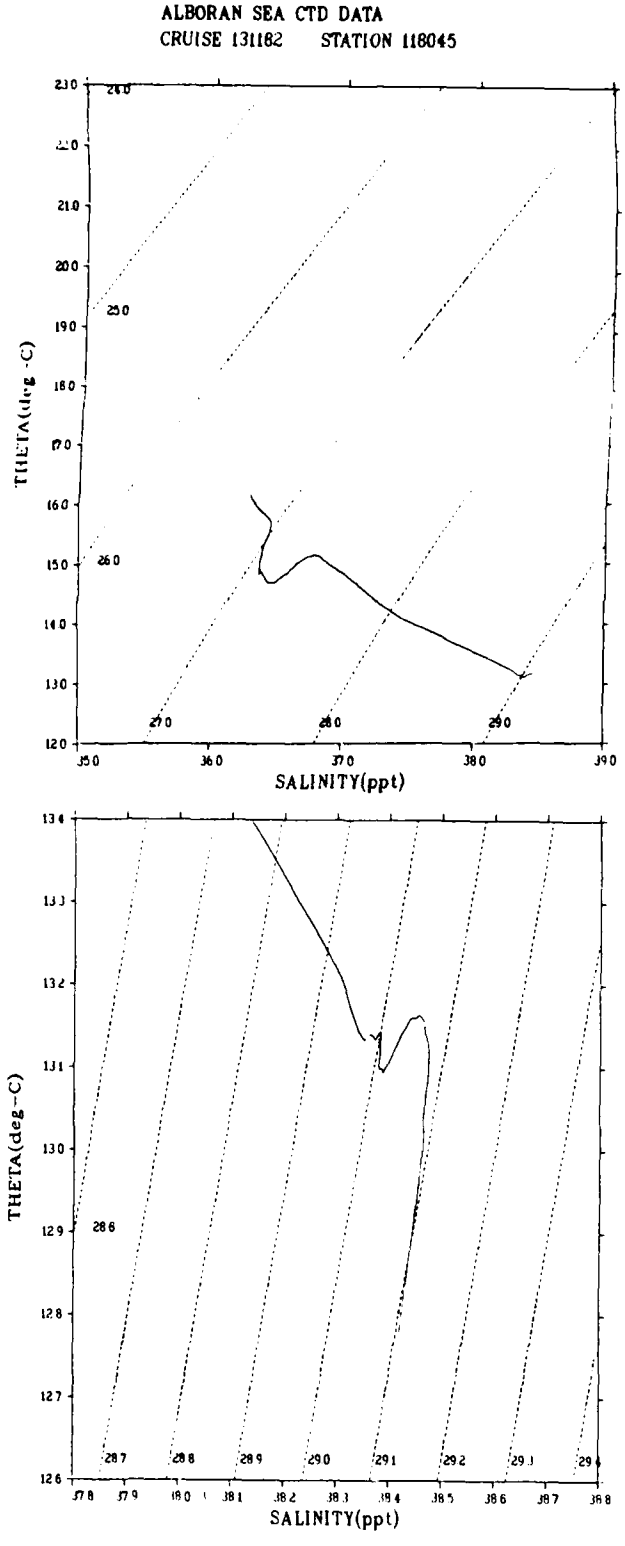


Figures 11a and 11b

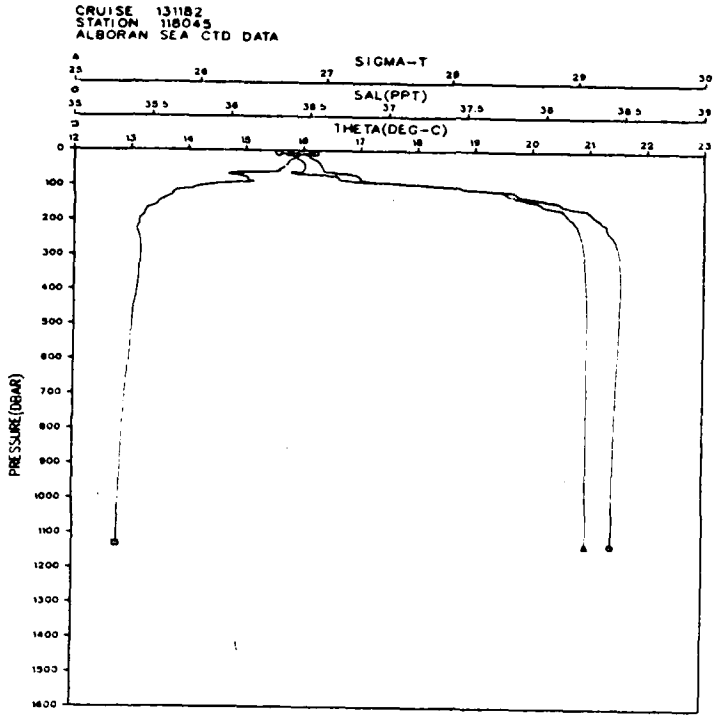


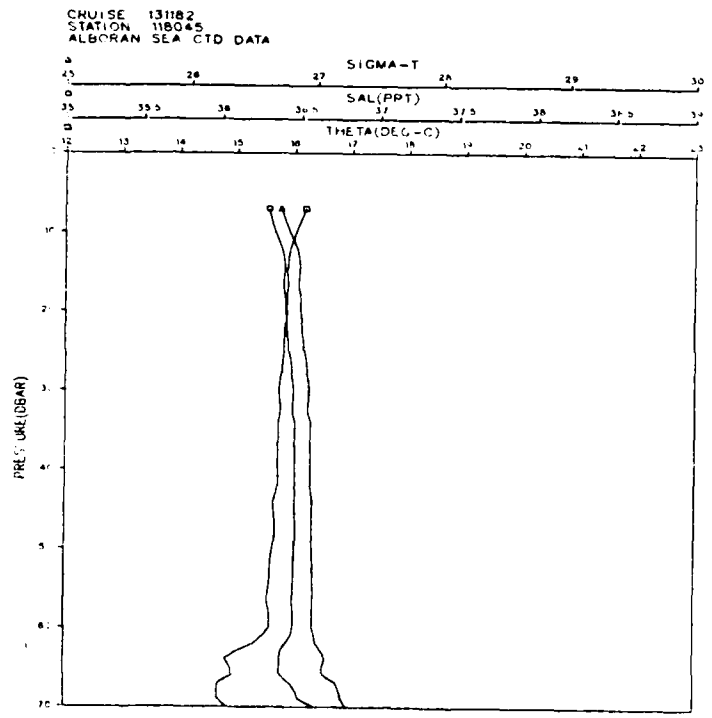


Figures 11c and 11d



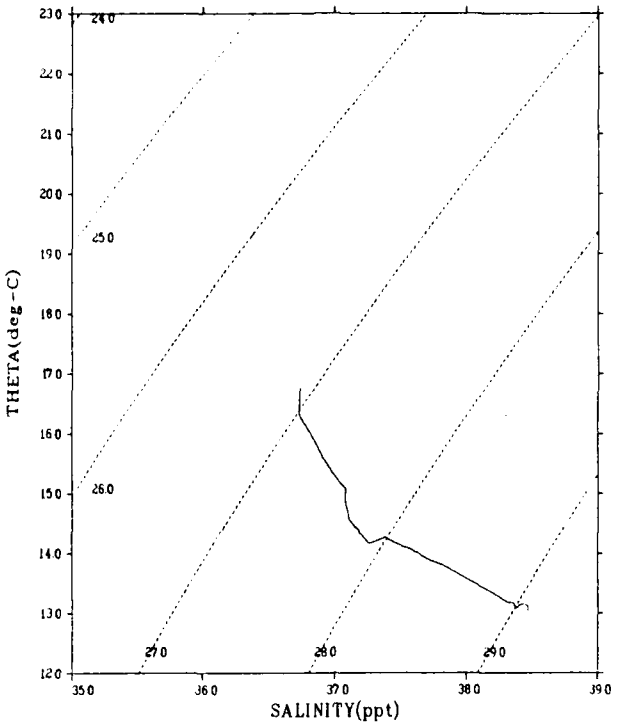
Figures 12a and 12b

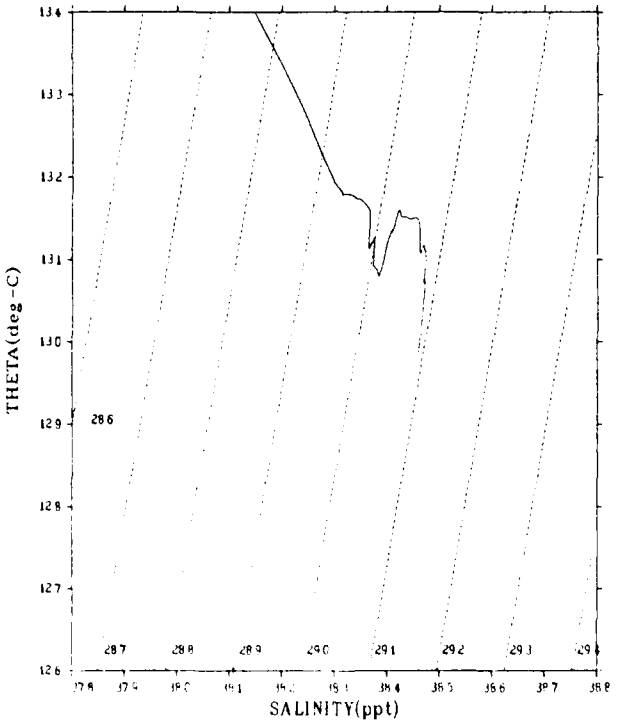




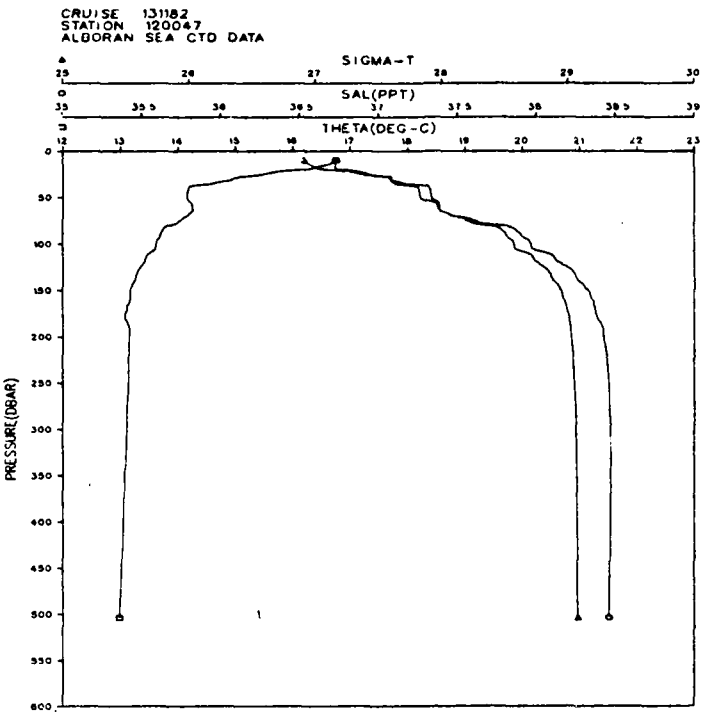
Figures 12c and 12d

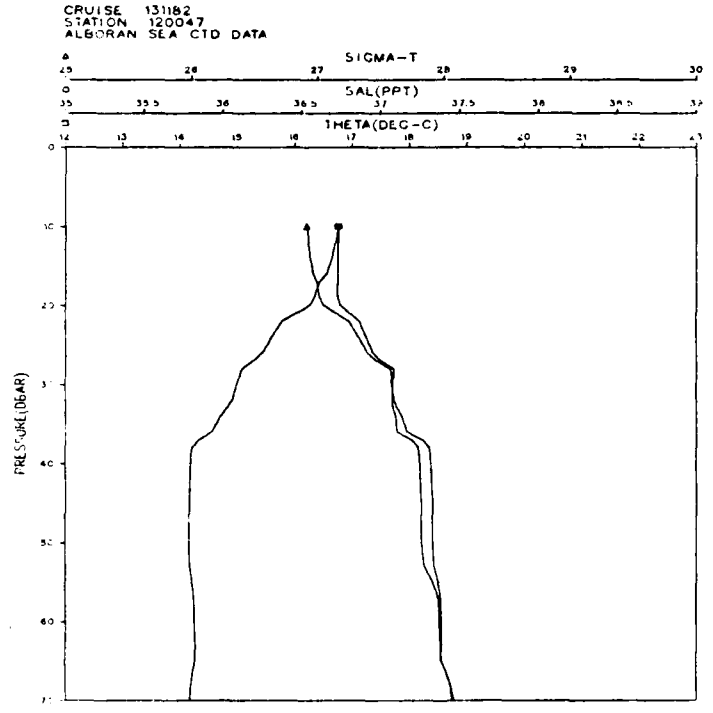
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 120047



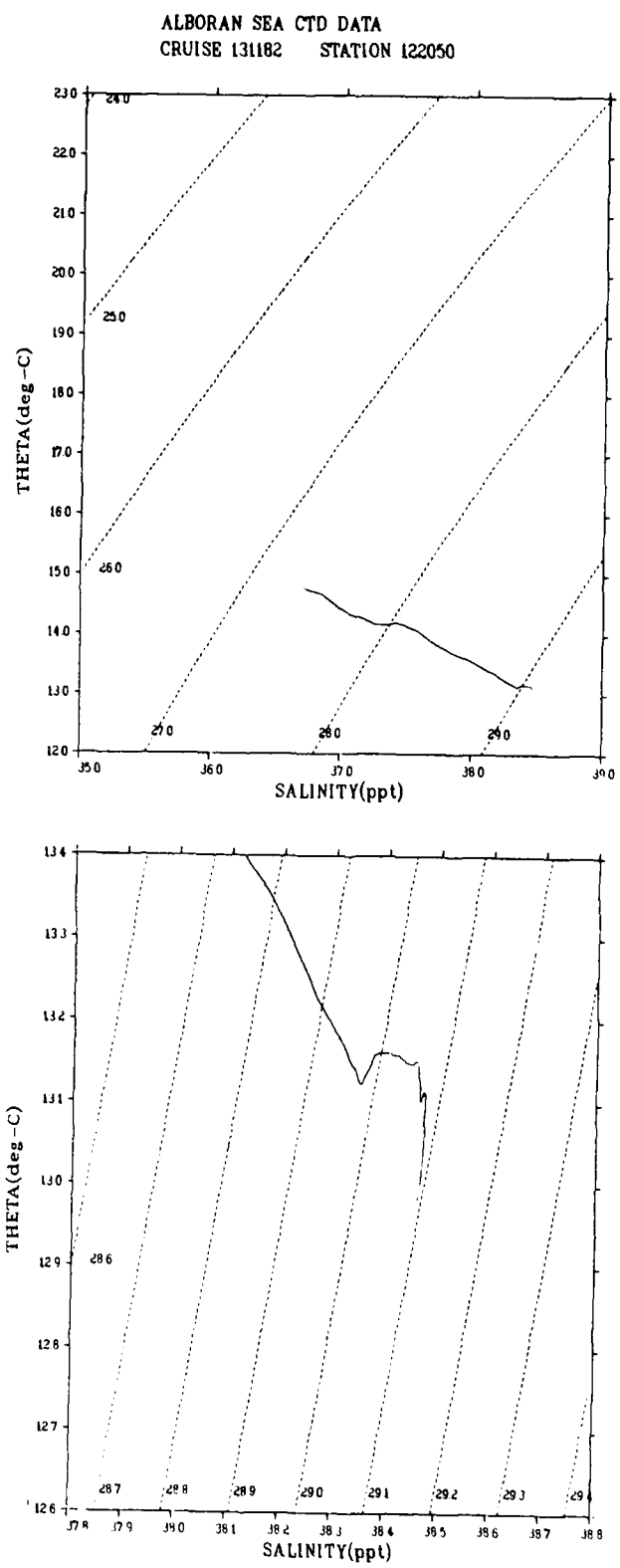


Figures 13a and 13b

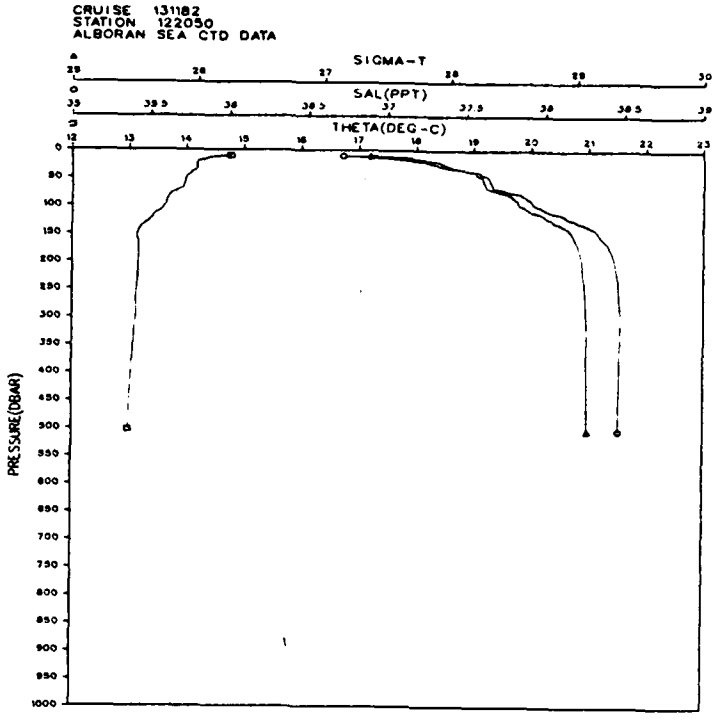


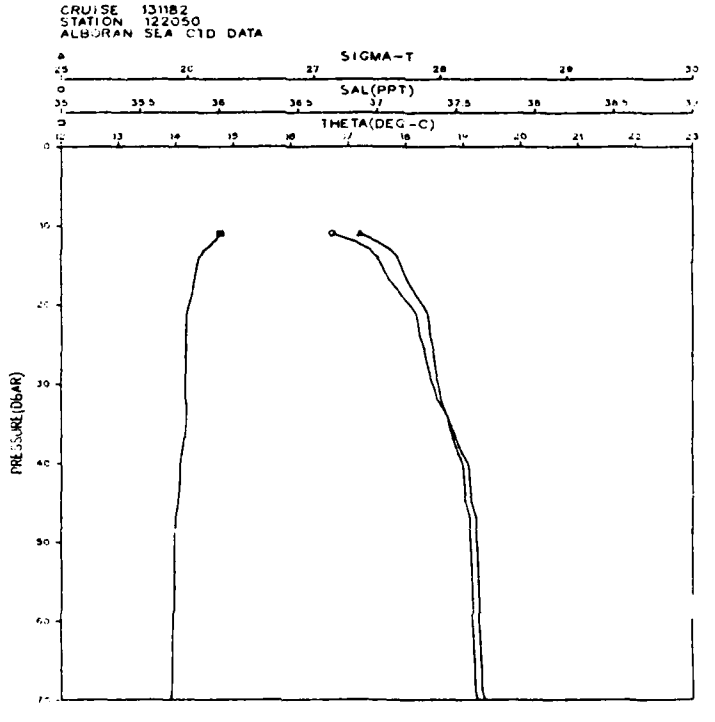


Figures 13c and 13d

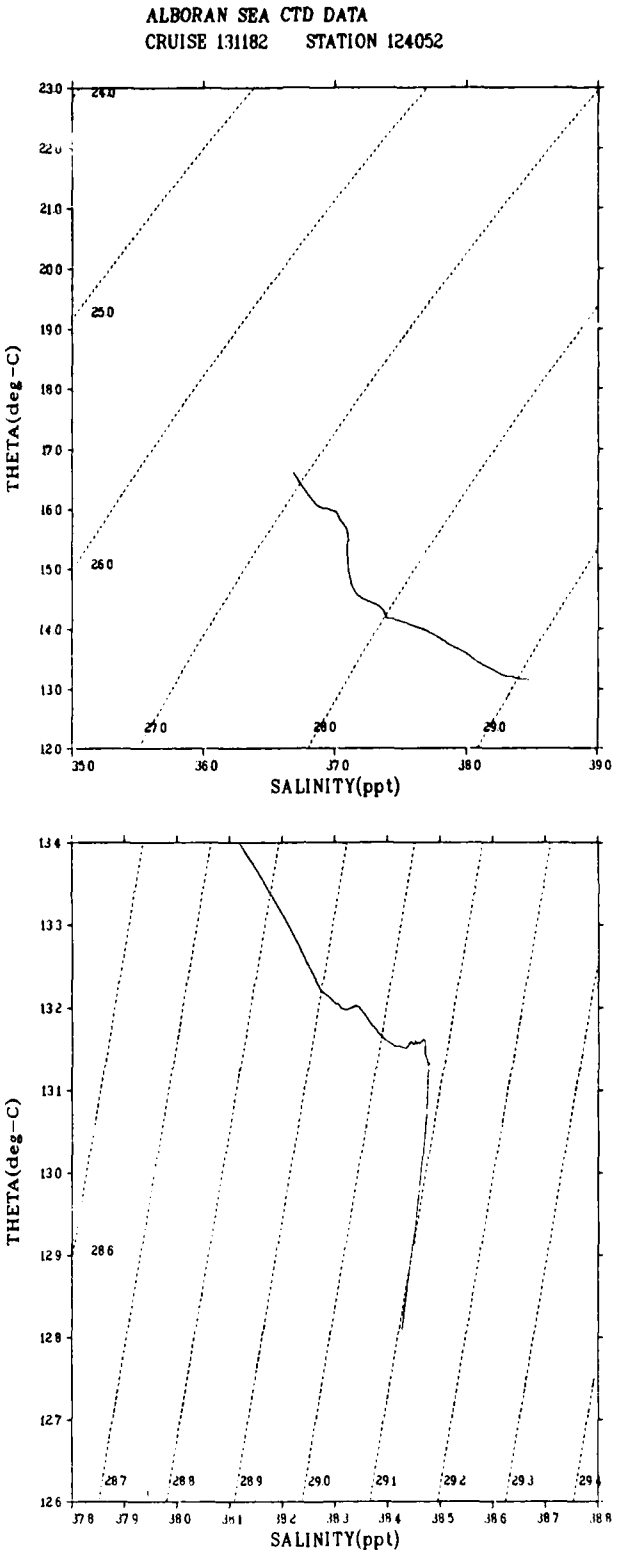


Figures 14a and 14b

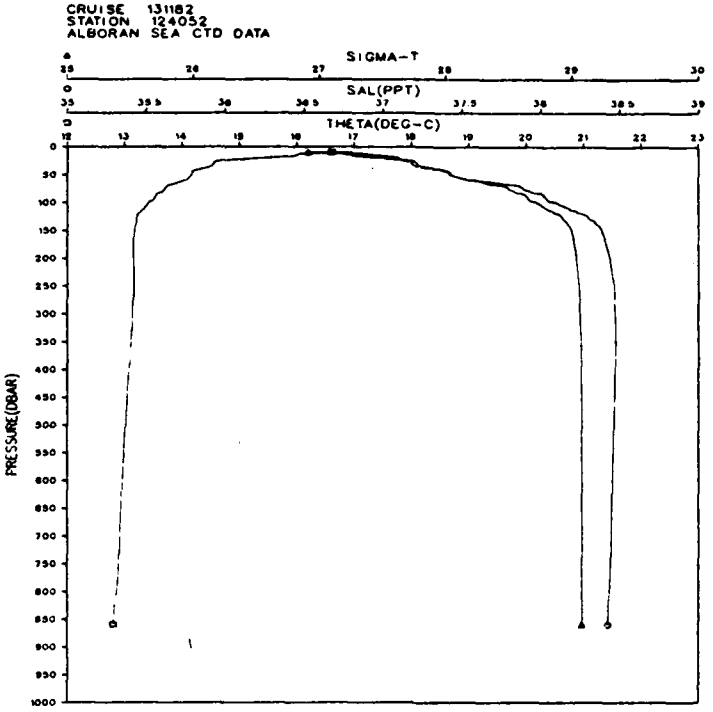


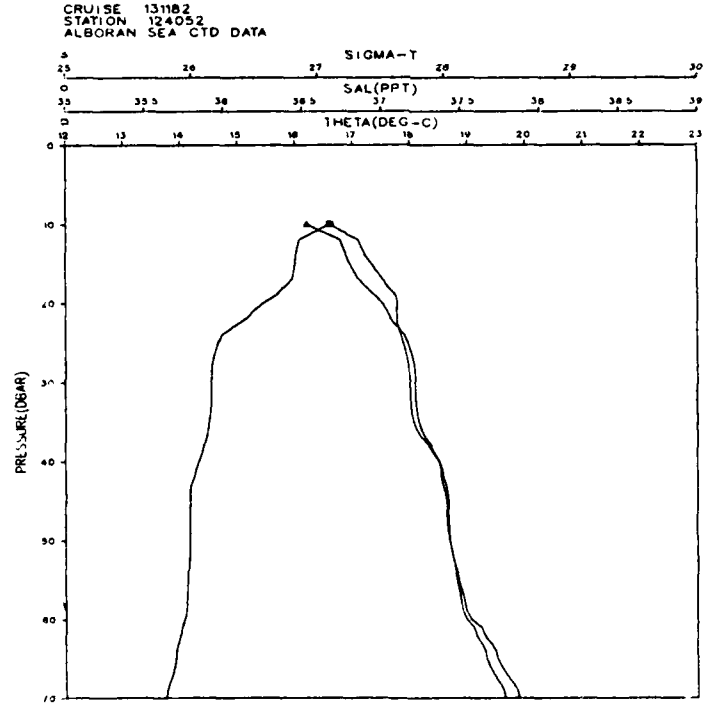


Figures 14c and 14d

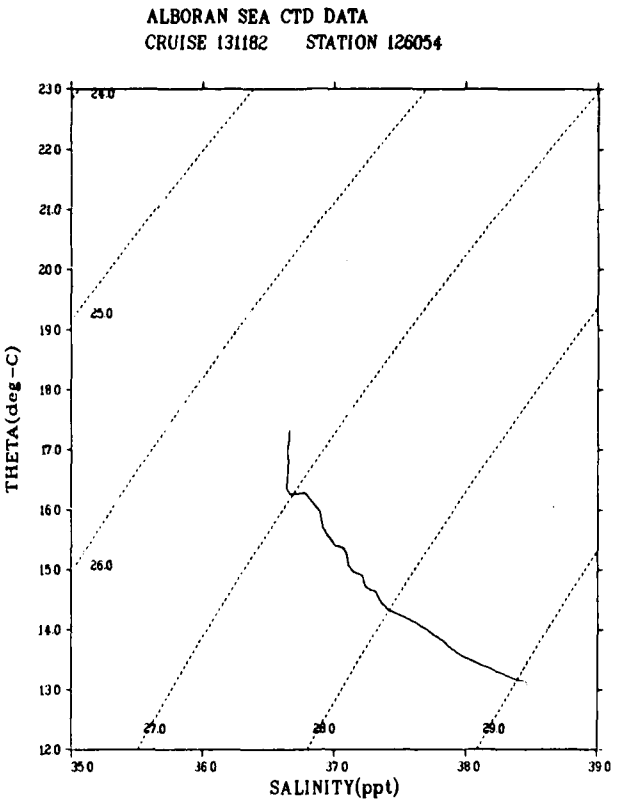


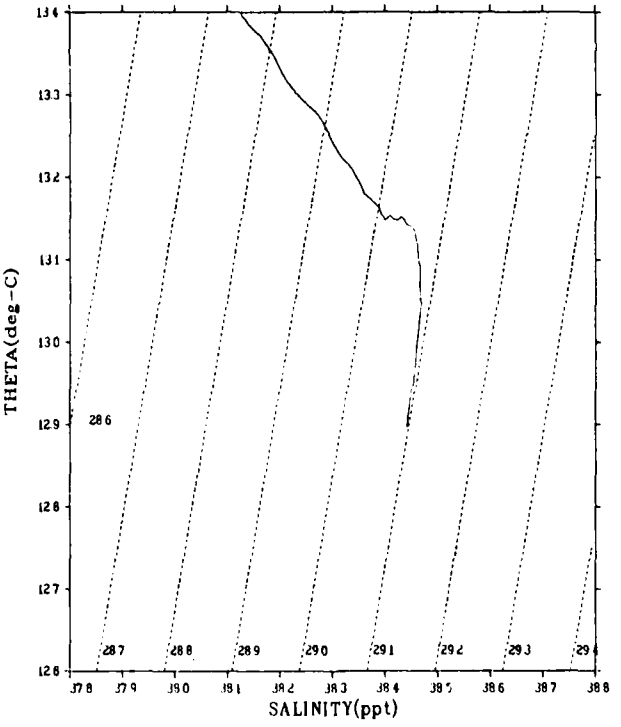
Figures 15a and 15b



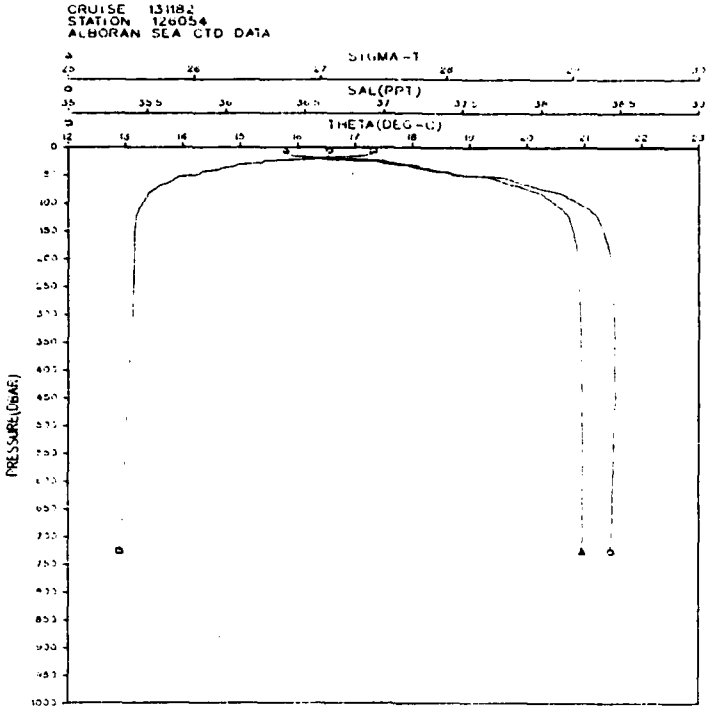


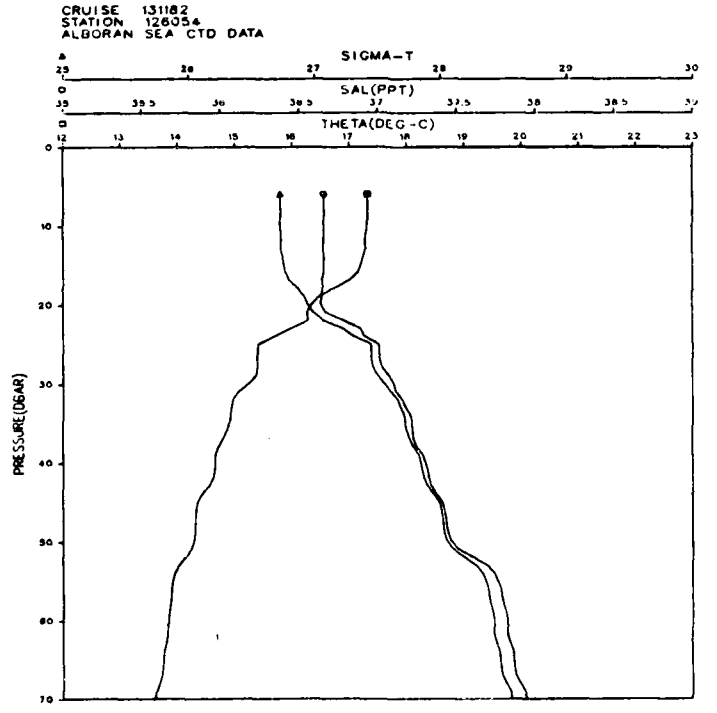
Figures 15c and 15d



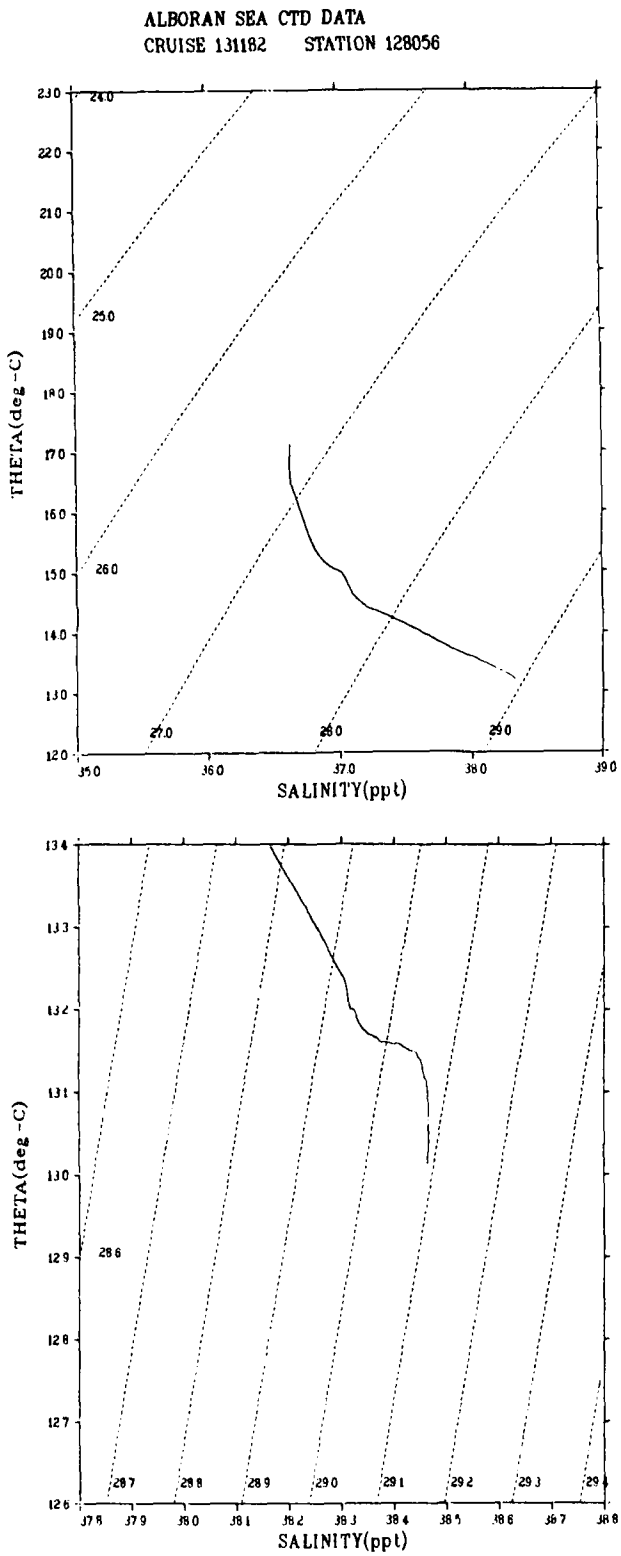


Figures 16a and 16b

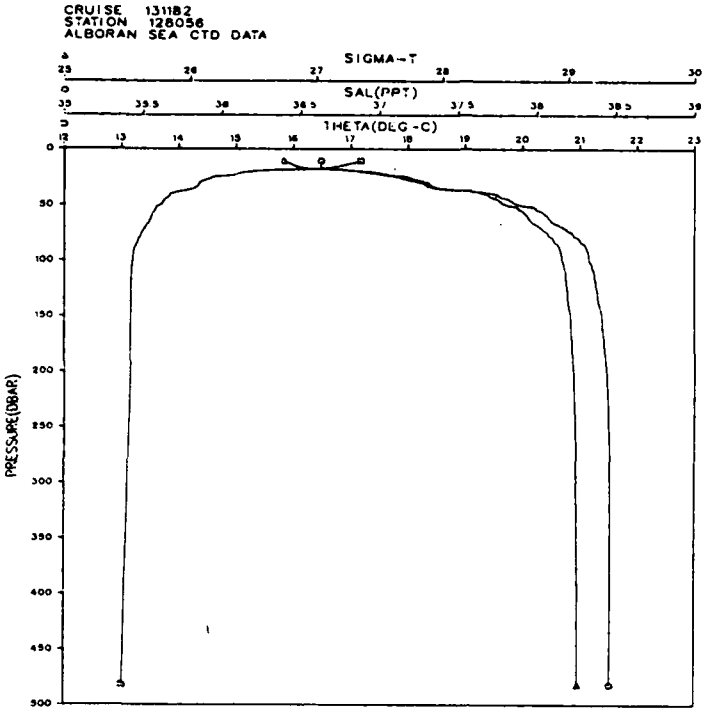


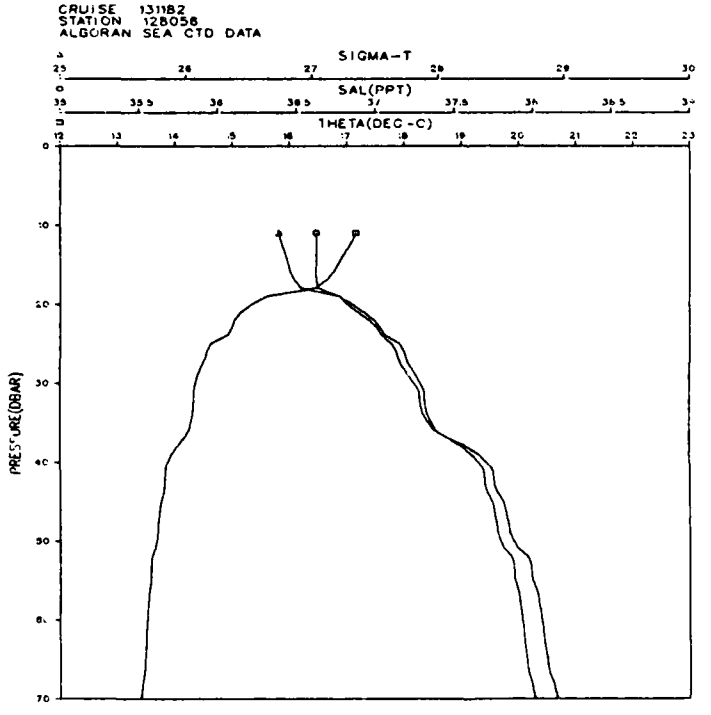


Figures 16c and 16d



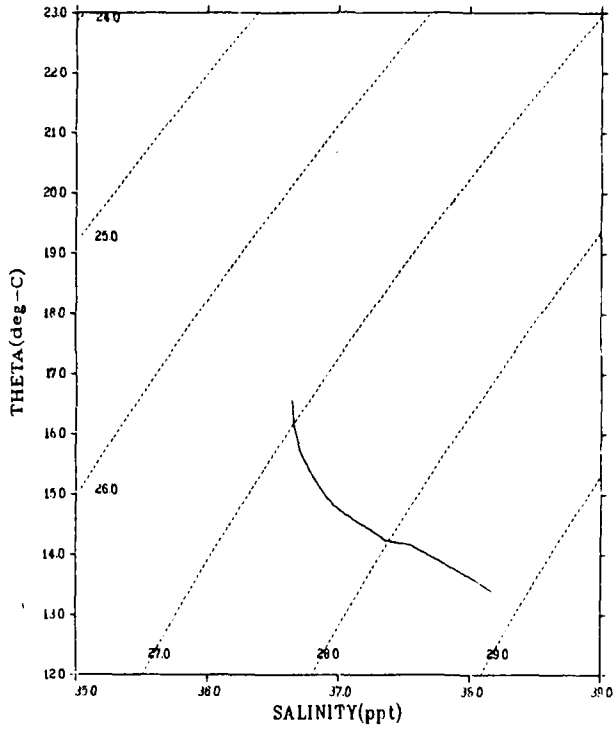
Figures 17a and 17b

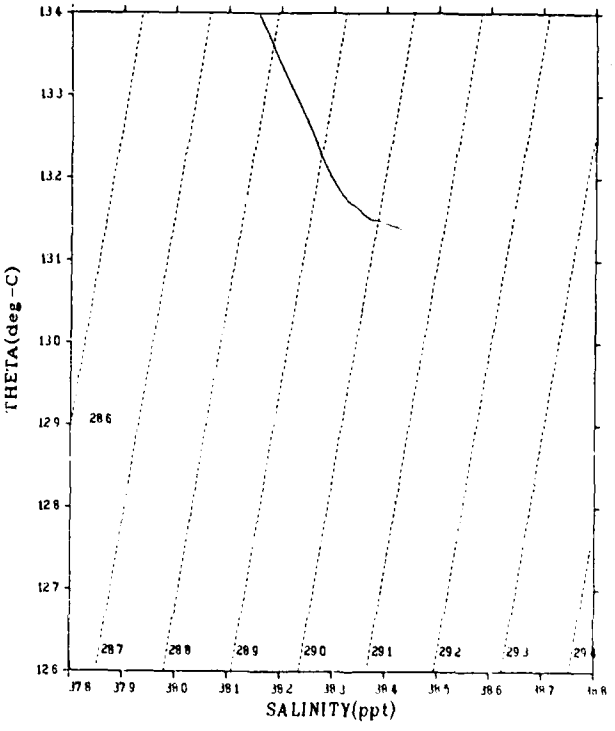




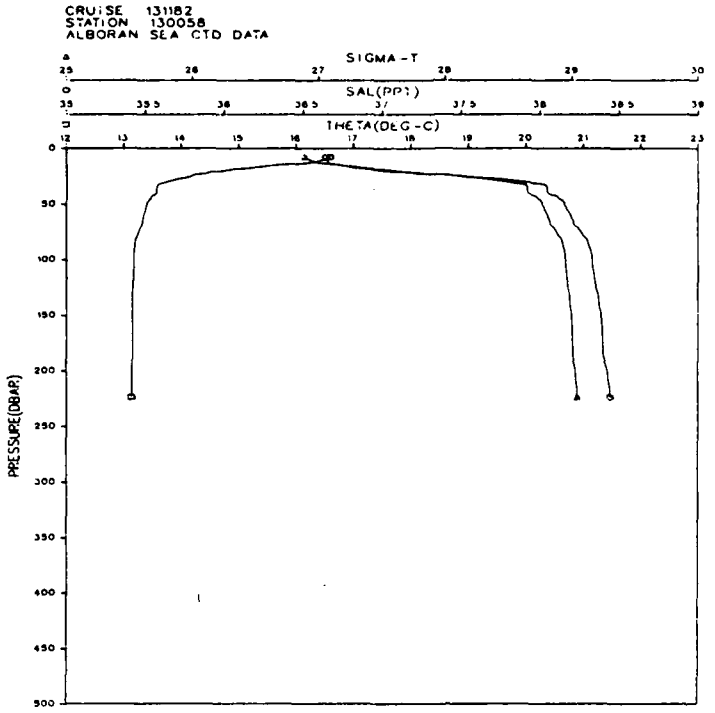
Figures 17c and 17d

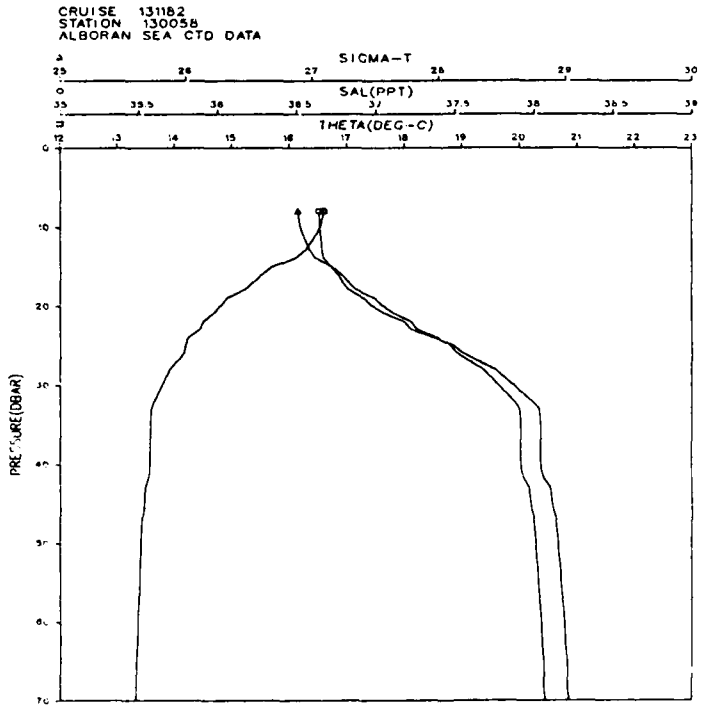
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 130058



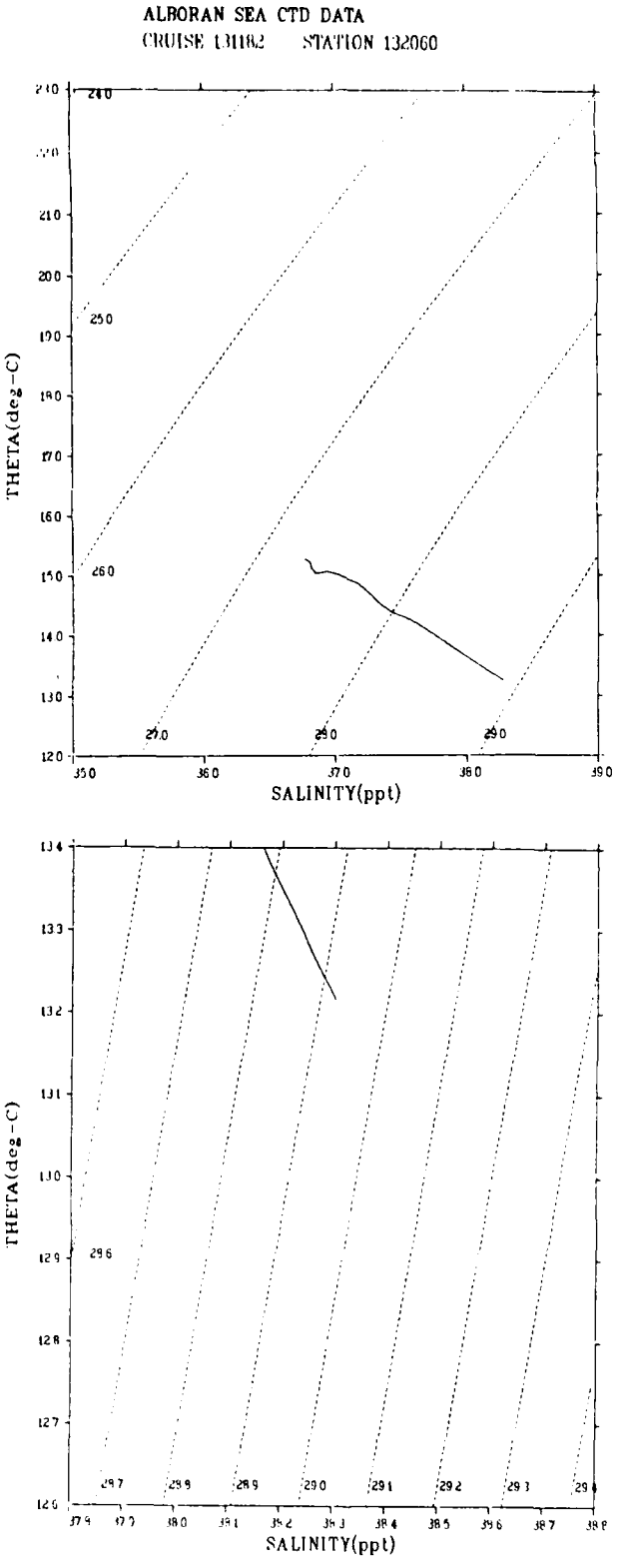


Figures 18a and 18b

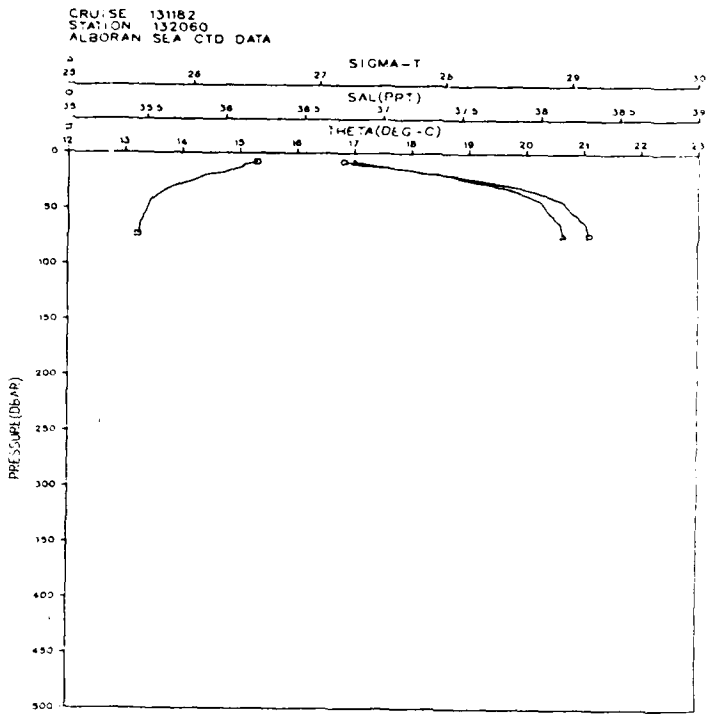


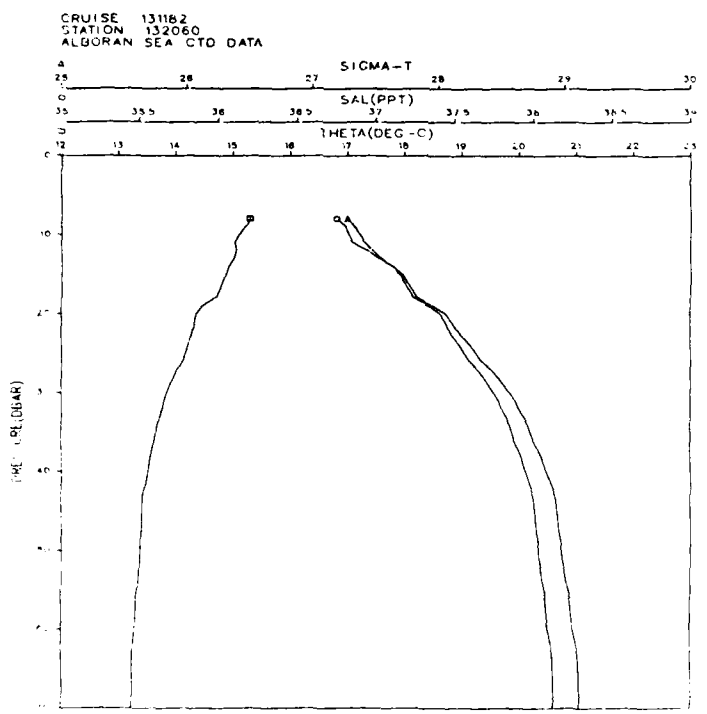


Figures 18c and 18d

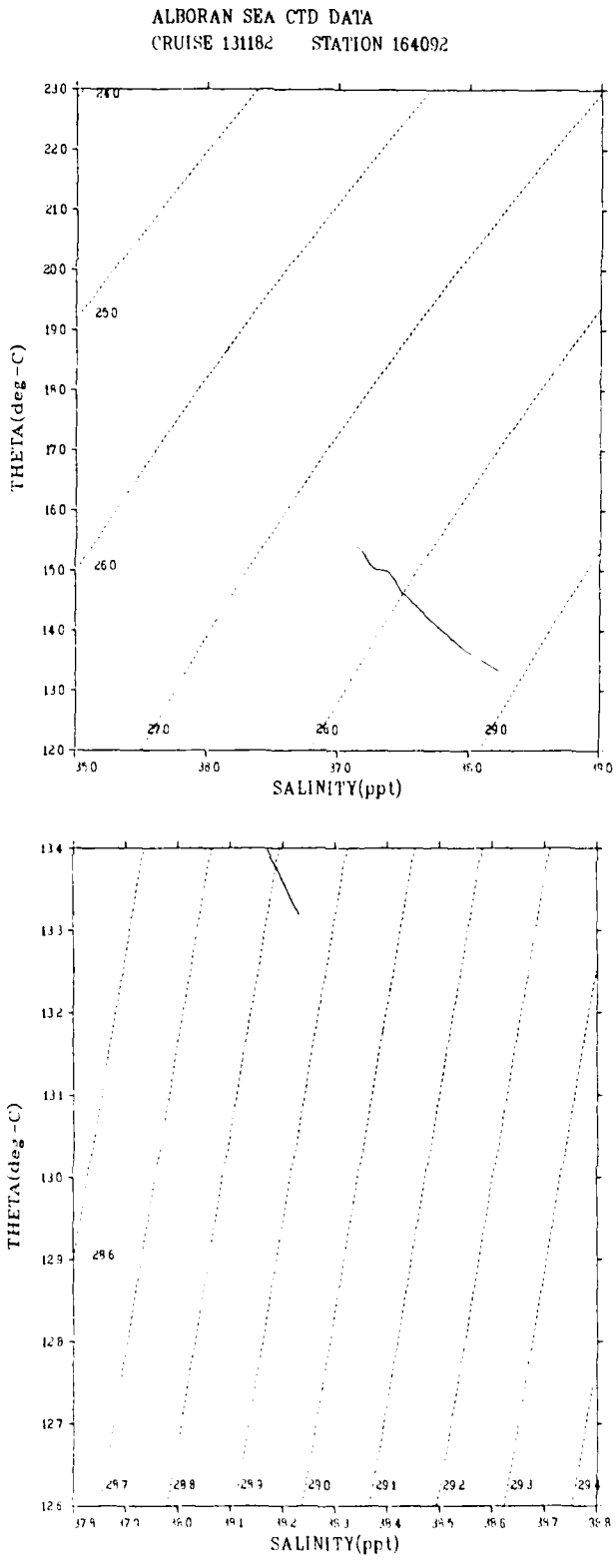


Figures 19a and 19b

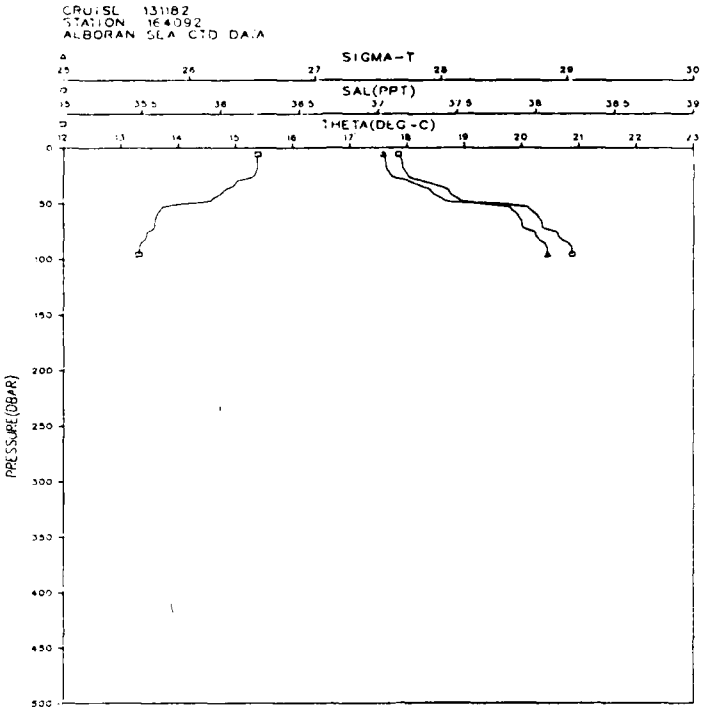


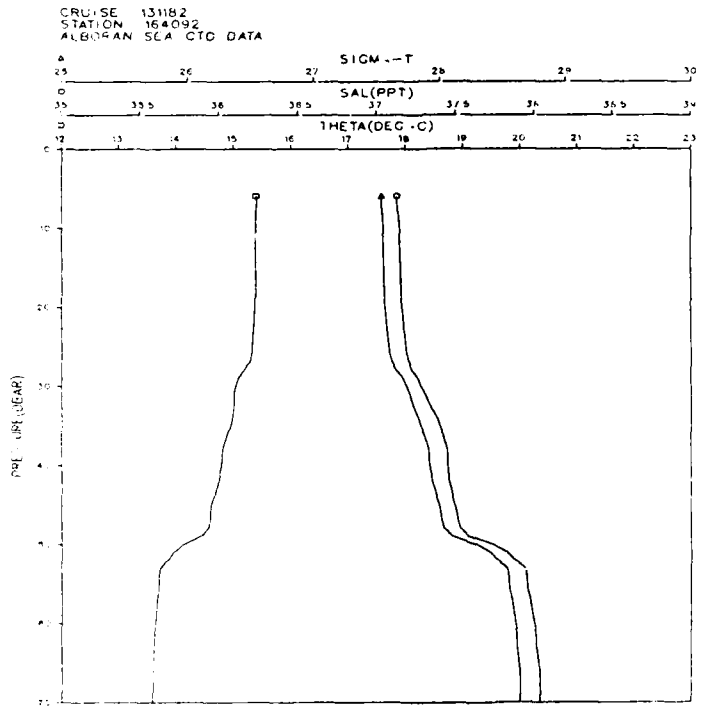


Figures 19c and 19d



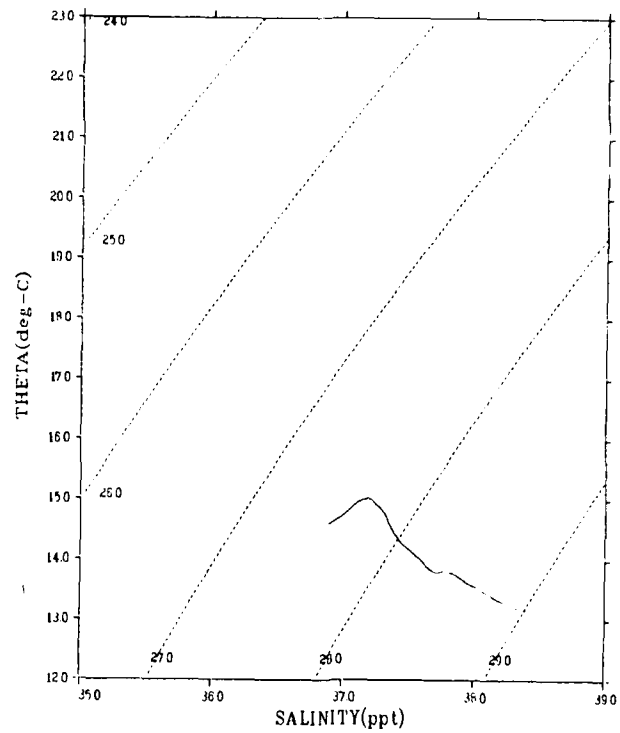
Figures 20a and 20b

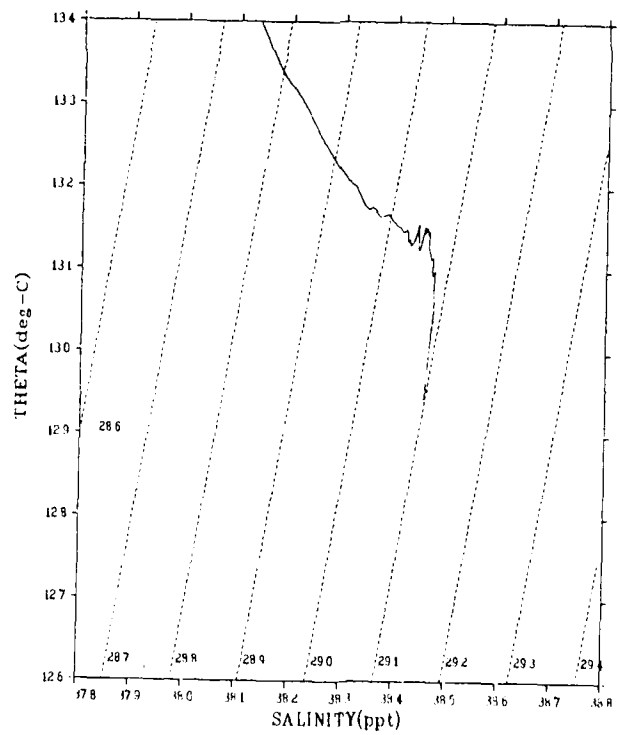




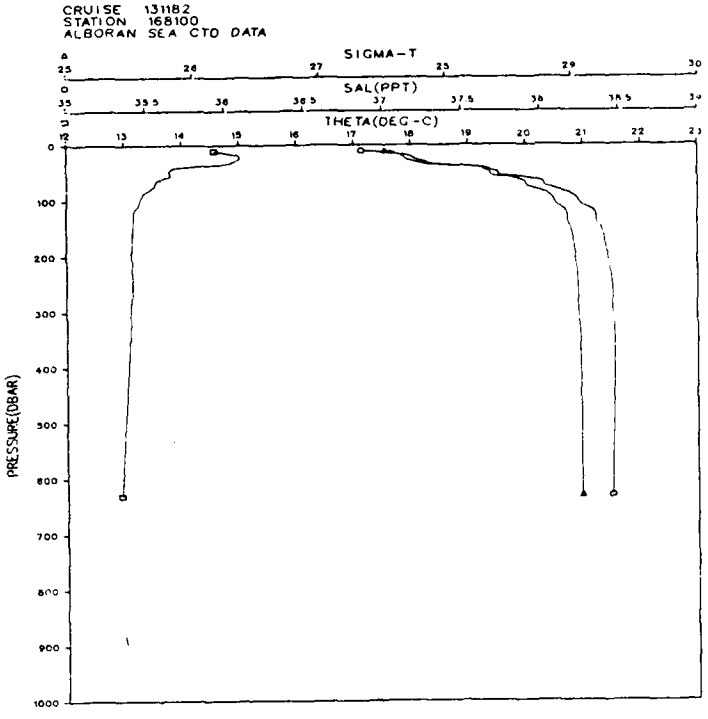
Figures 20c and 20d

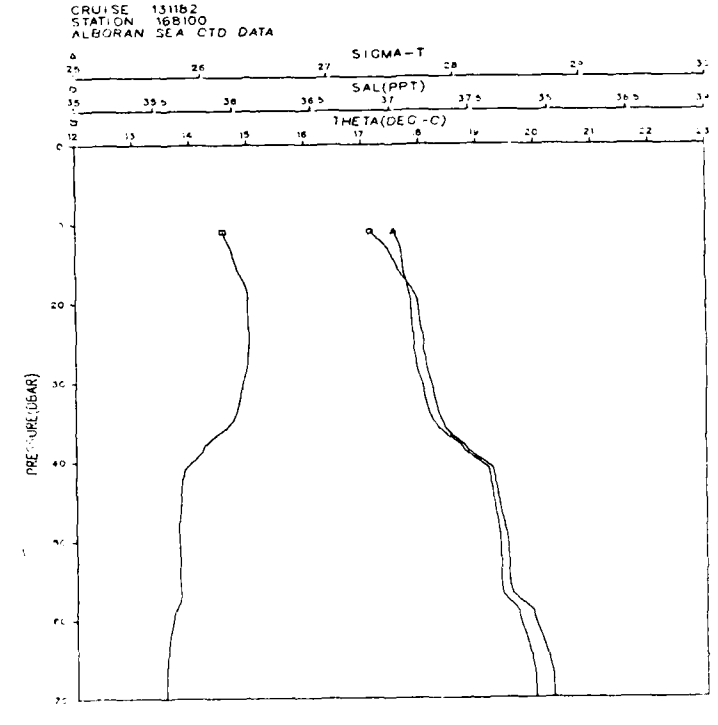
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 168100



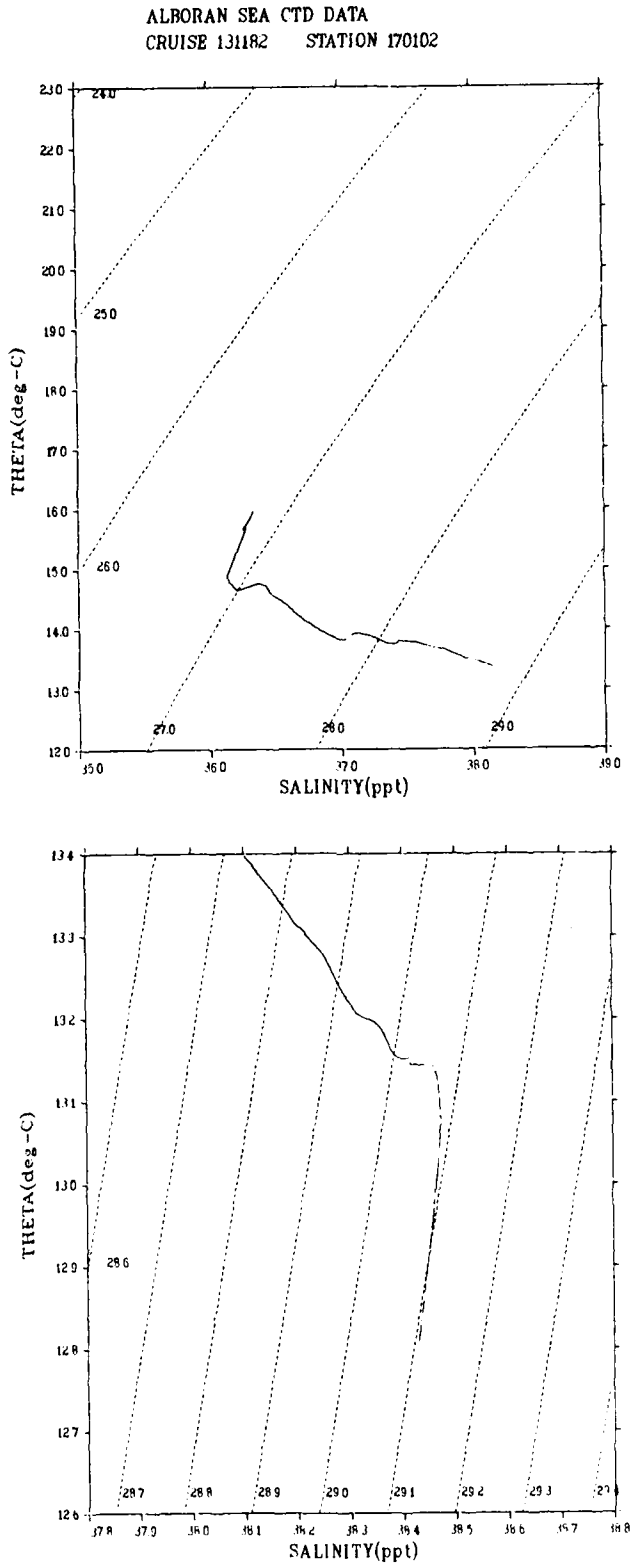


Figures 21a and 21b

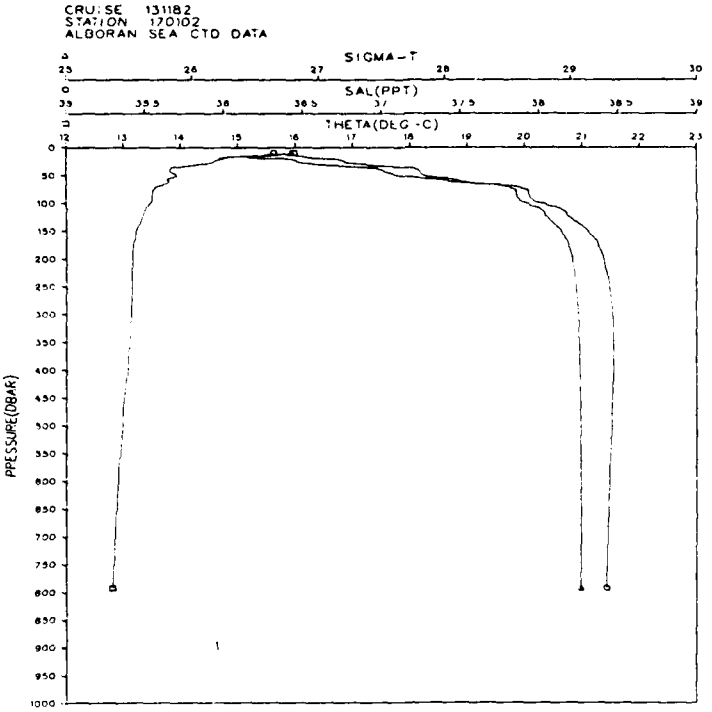


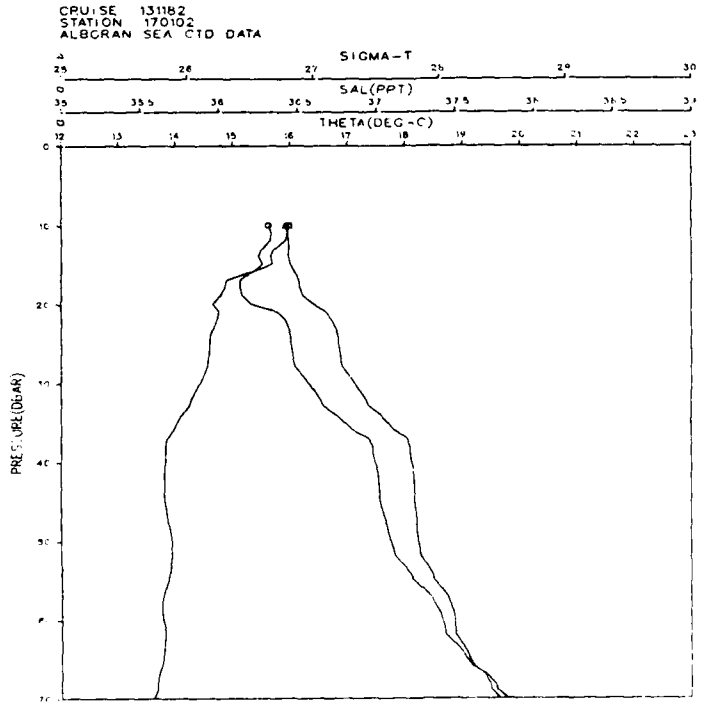


Figures 21c and 21d

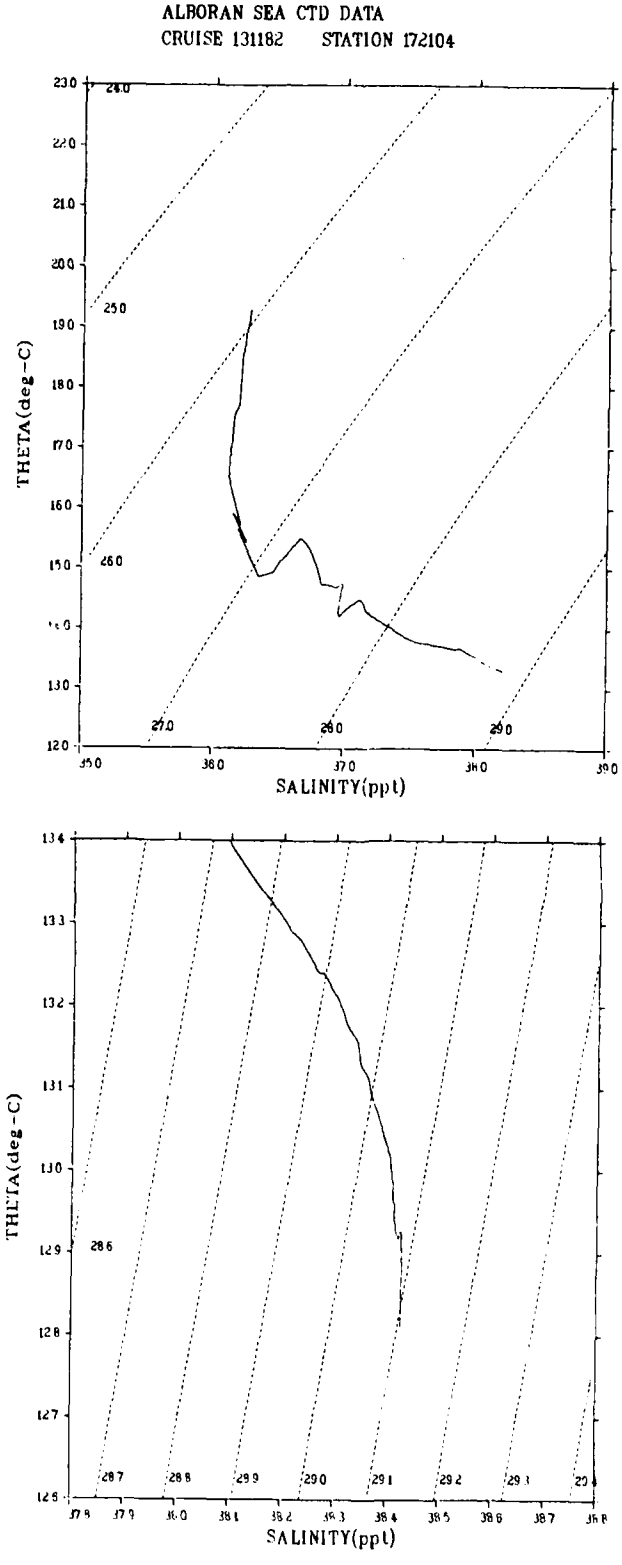


Figures 22a and 22b

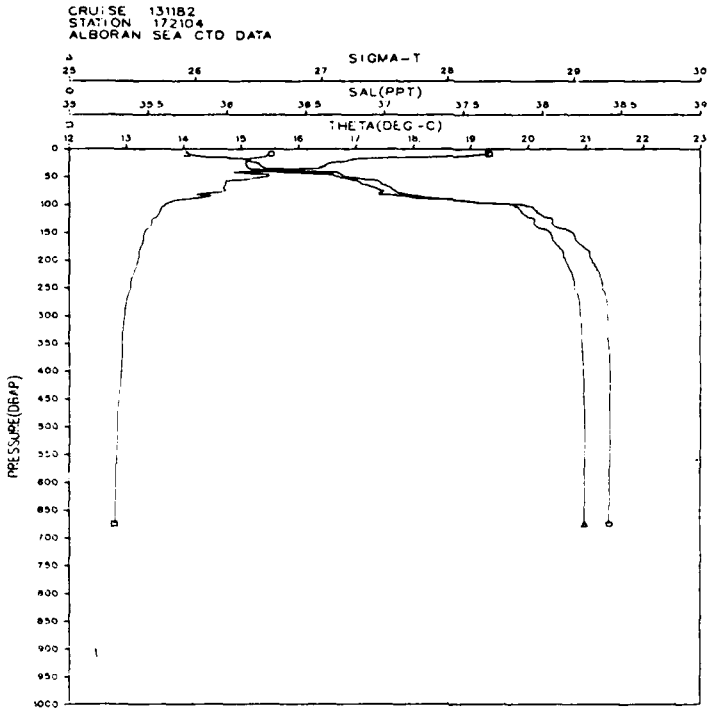


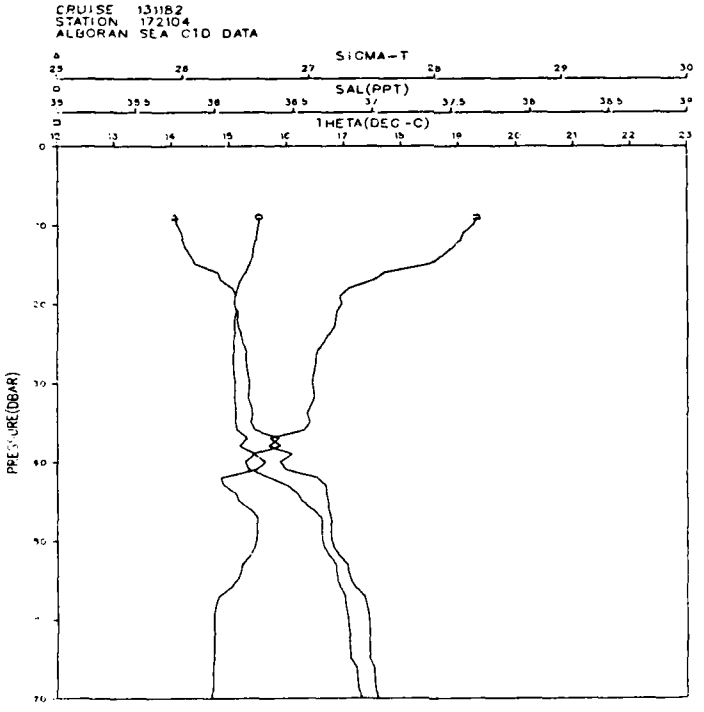


Figures 22c and 22d

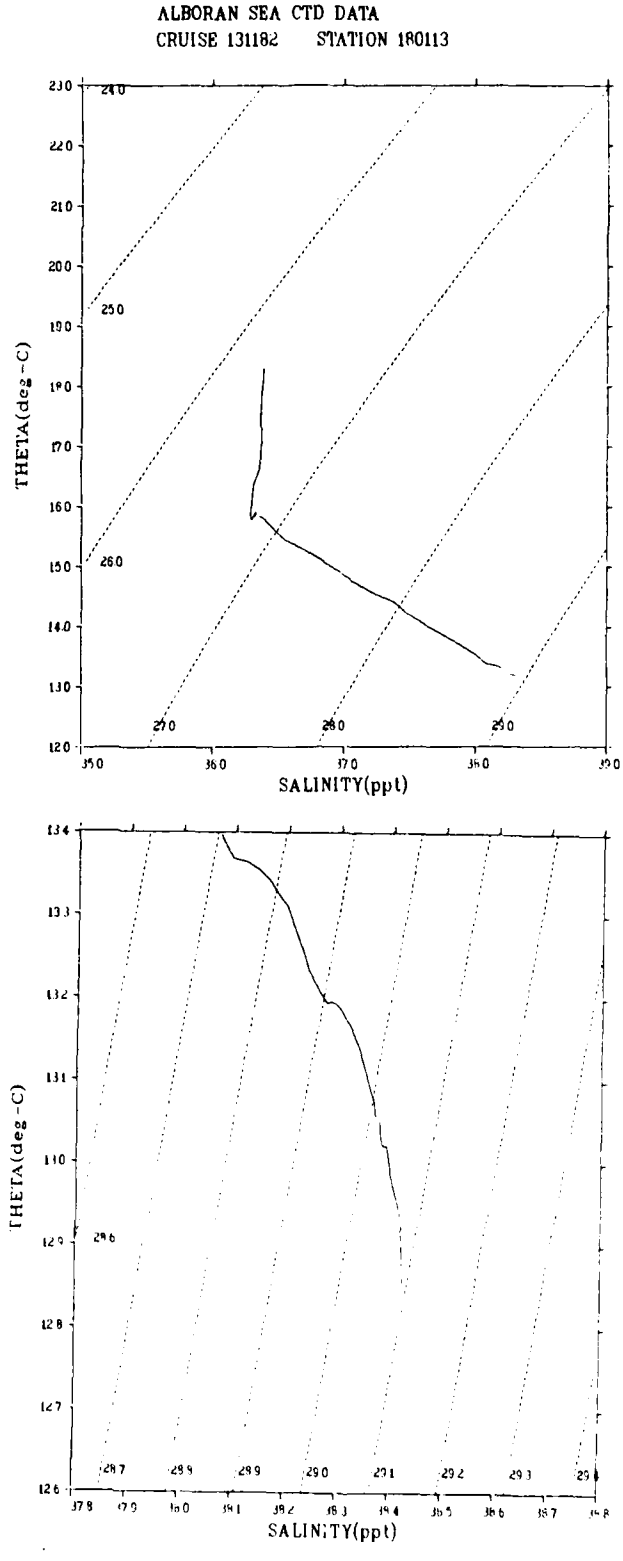


Figures 23a and 23b

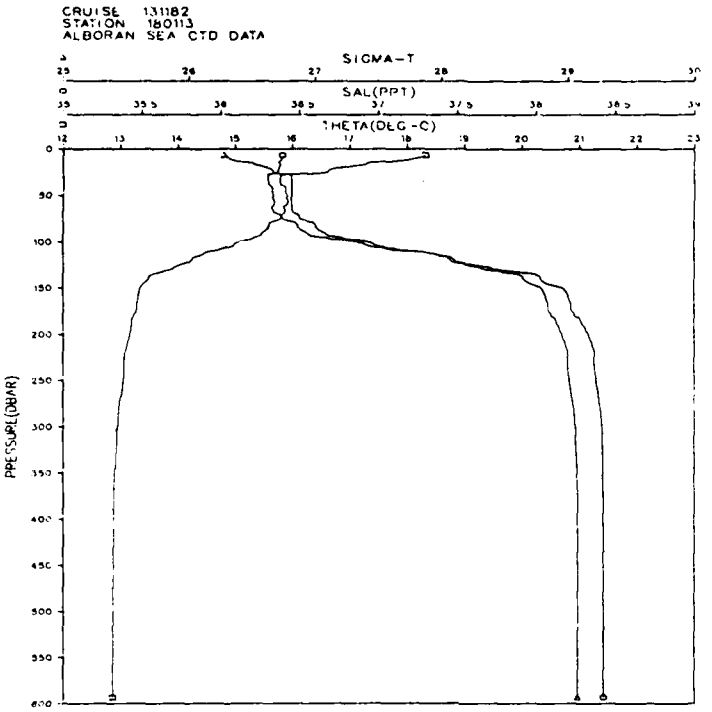


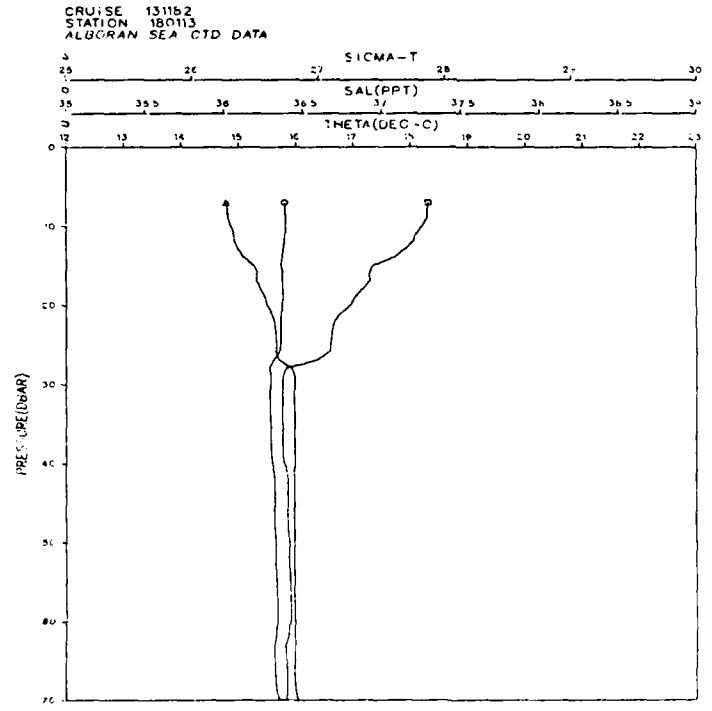


Figures 23c and 23d

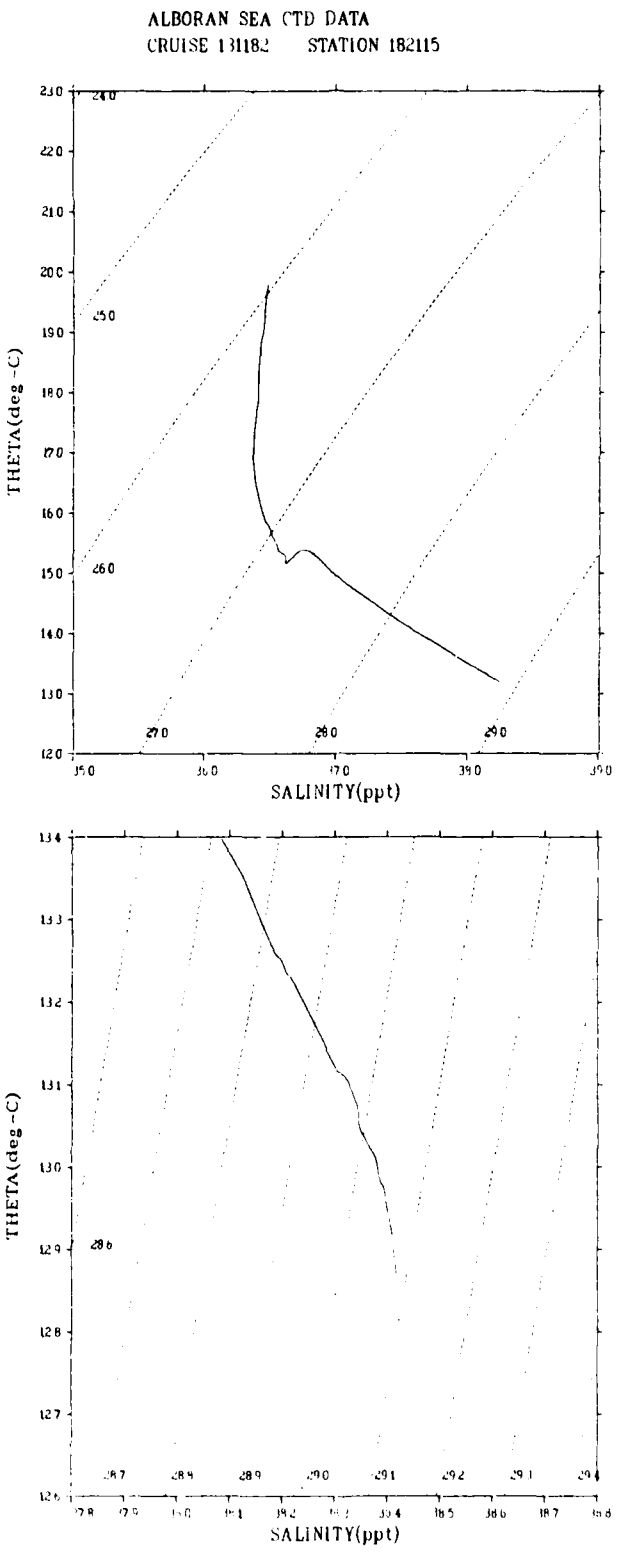


Figures 24a and 24b

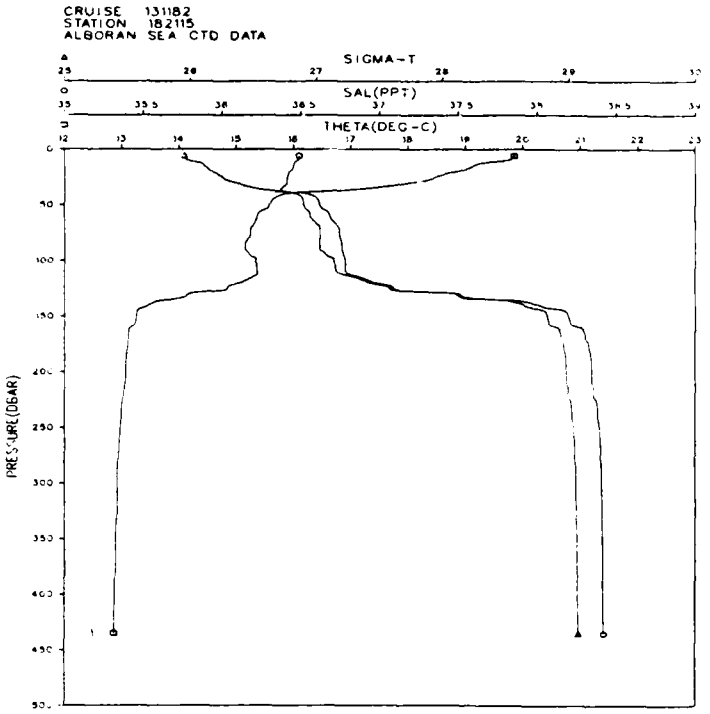


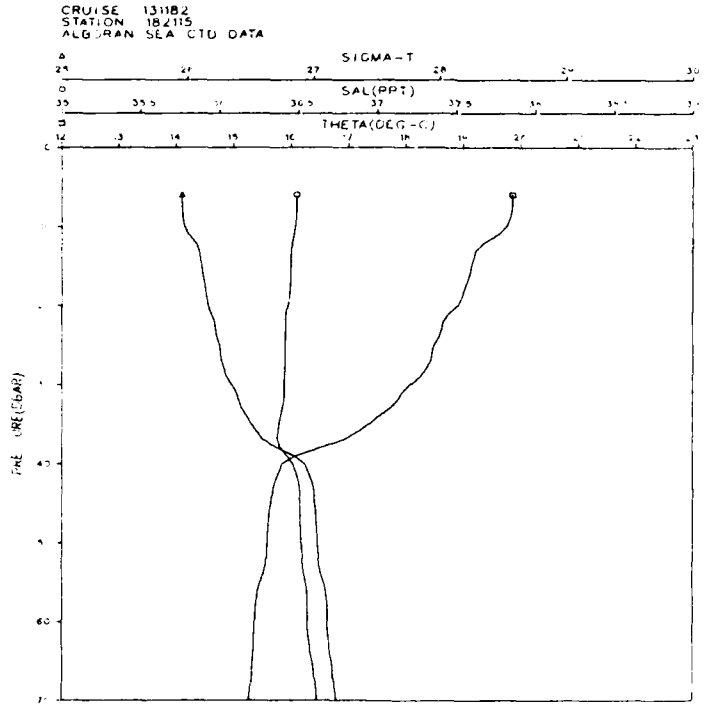


Figures 24c and 24d

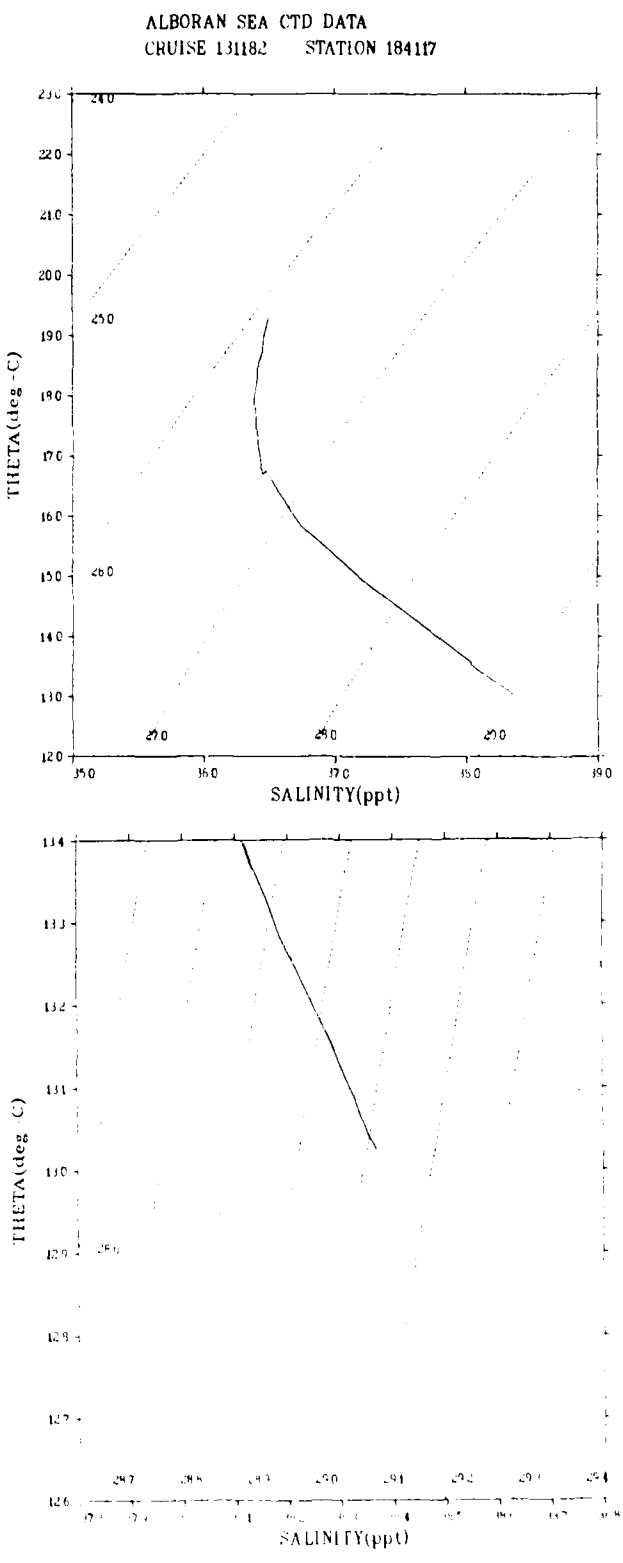


Figures 25a and 25b

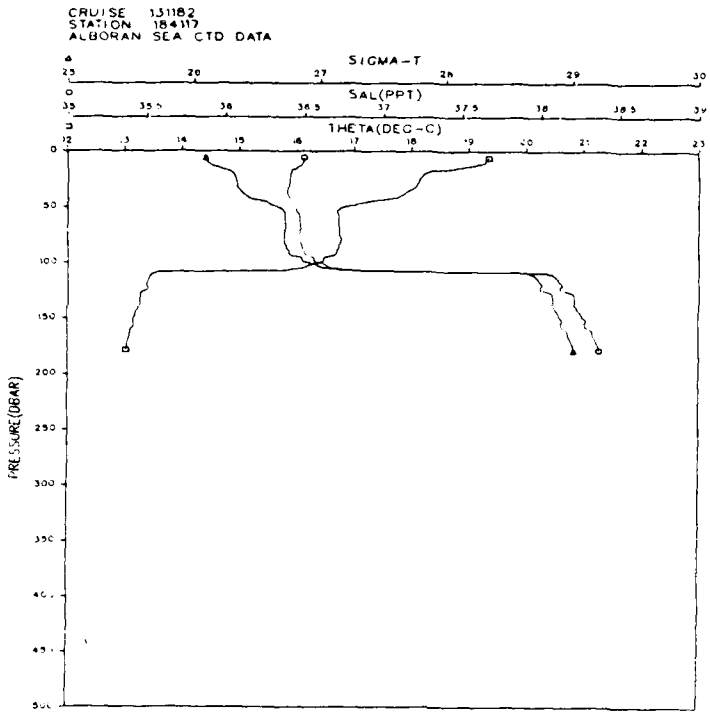


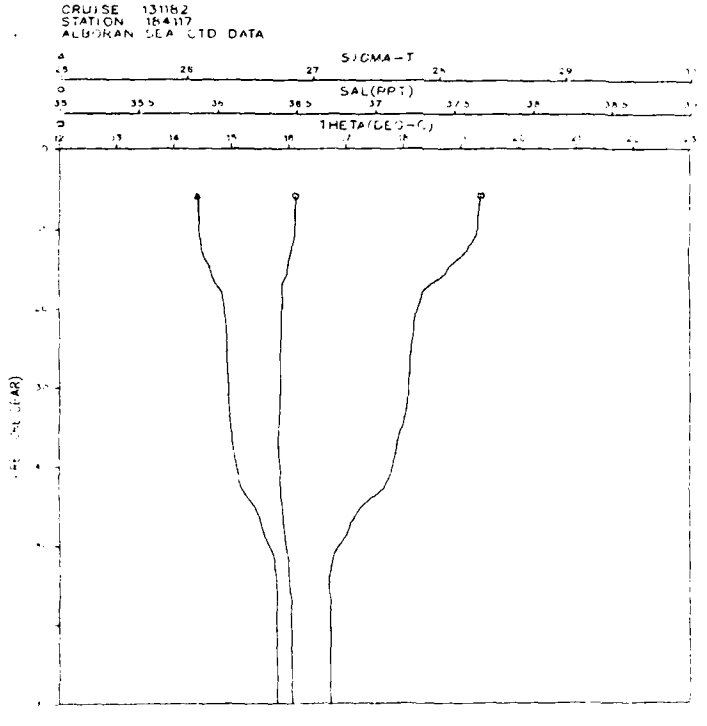


Figures 25c and 25d

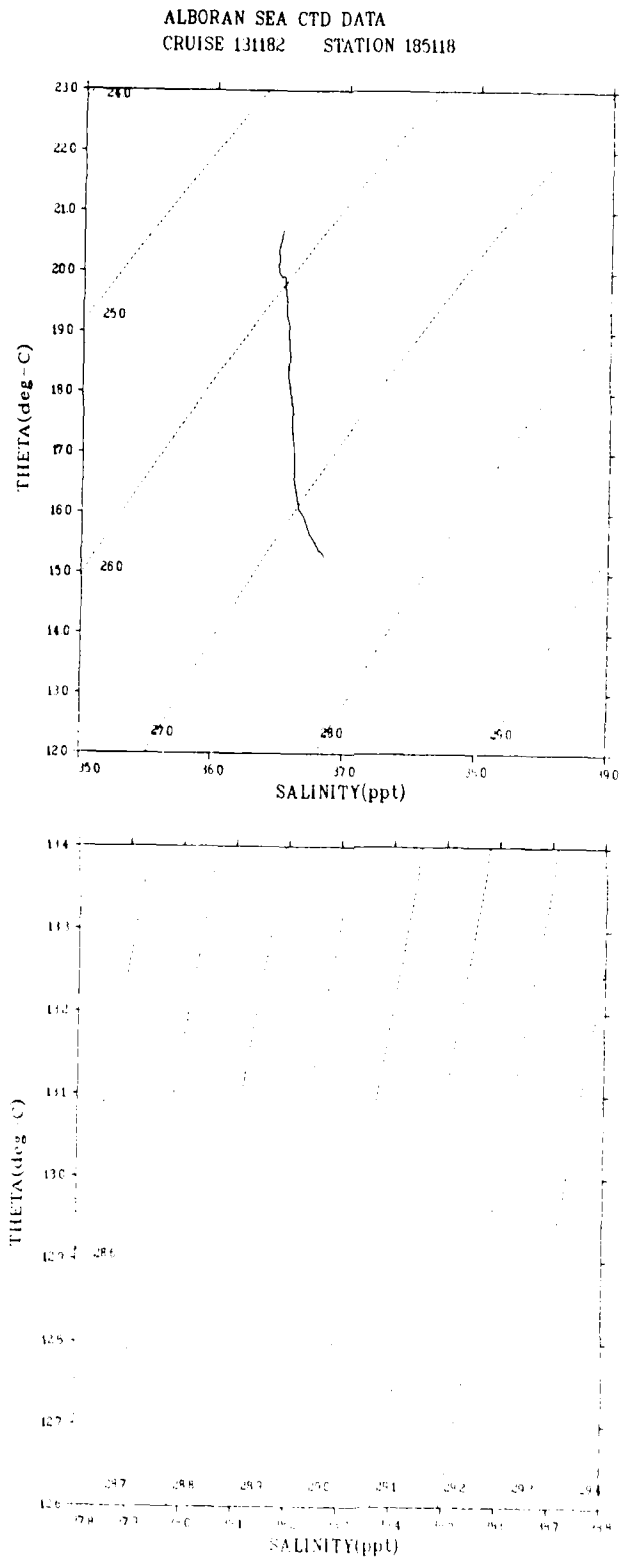


Figures 26a and 26b

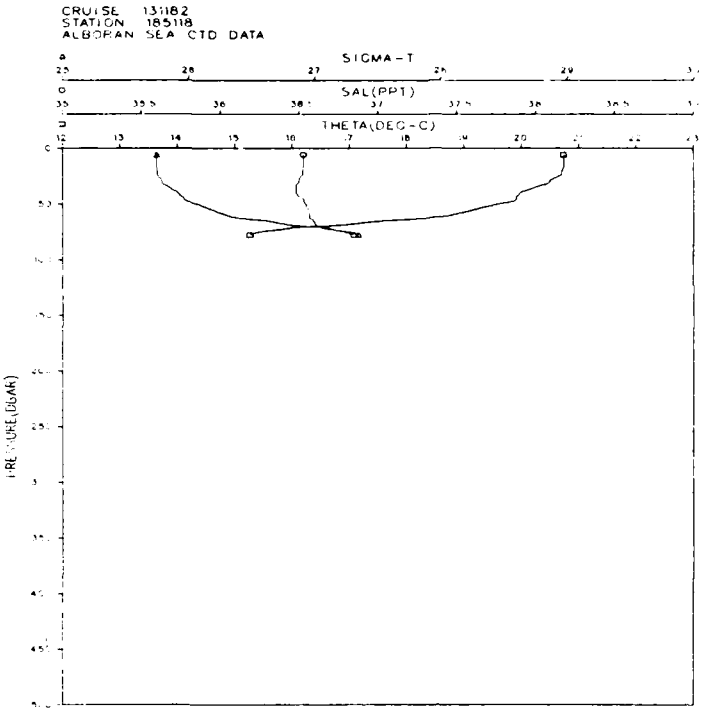


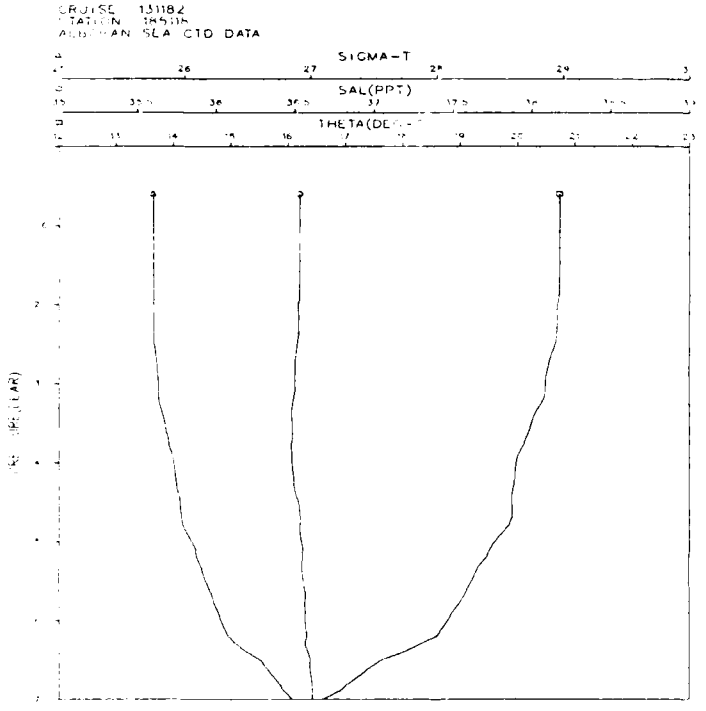


Figures 26c and 26d



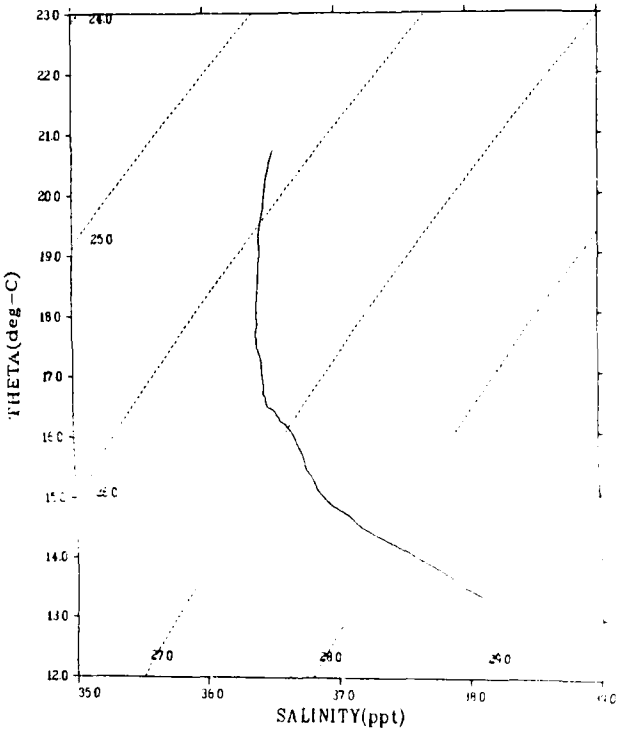
Figures 27a and 27b

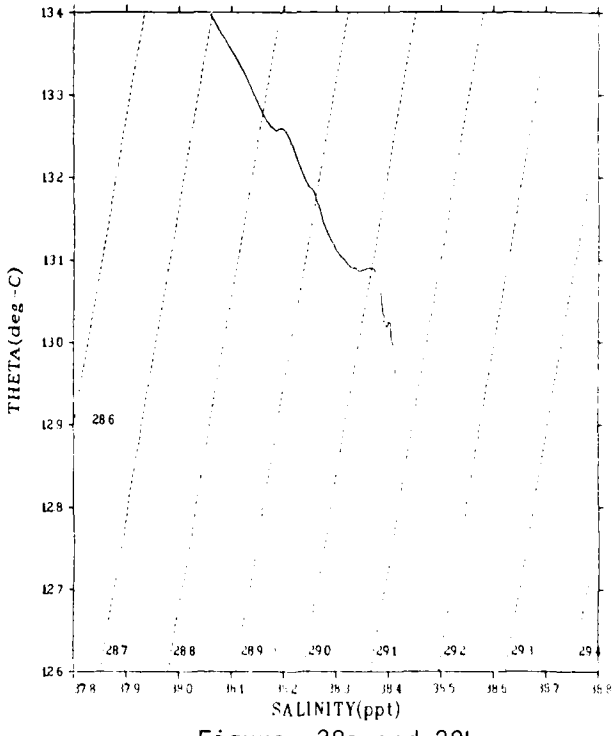




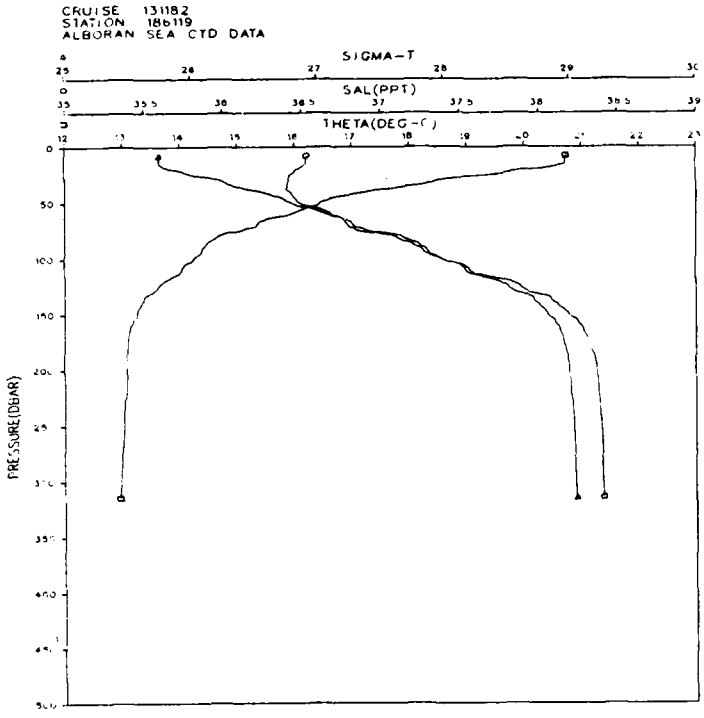
Figures 27c and 27d

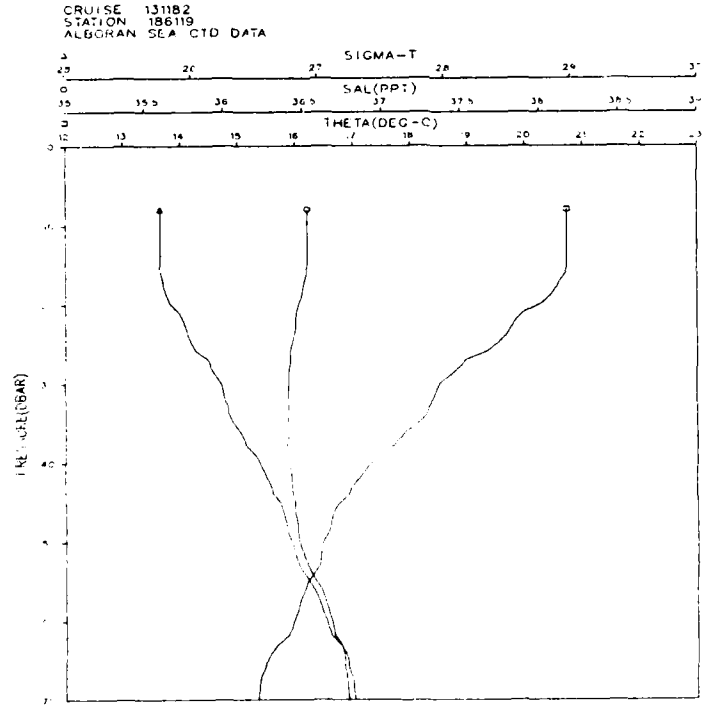
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 186119





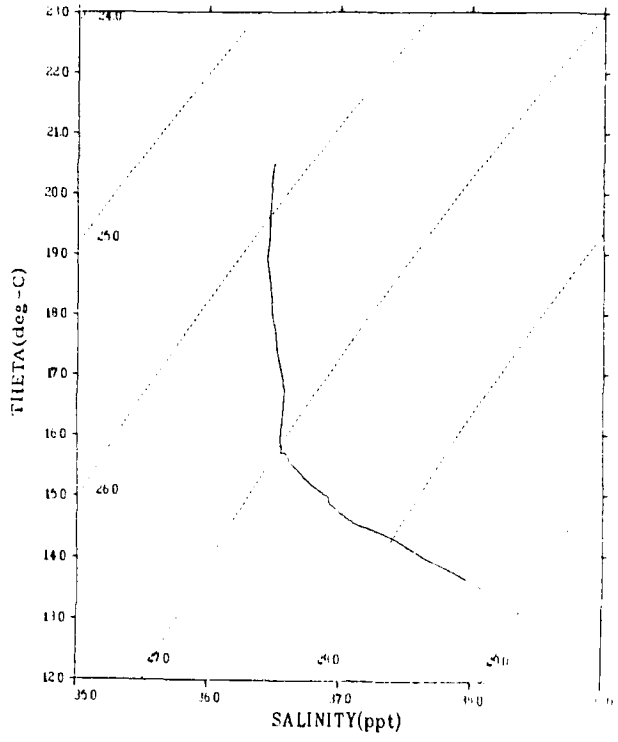
Figures 28a and 28b

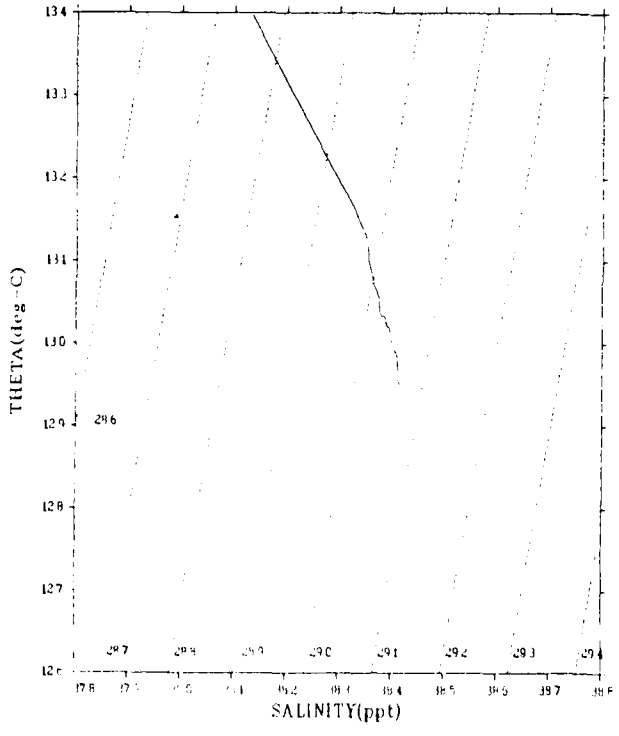




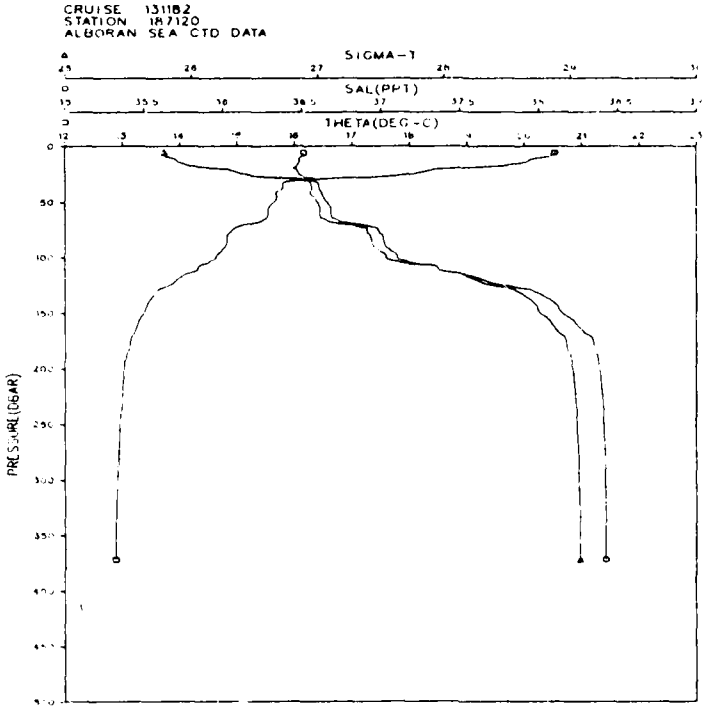
Figures 28c and 28d

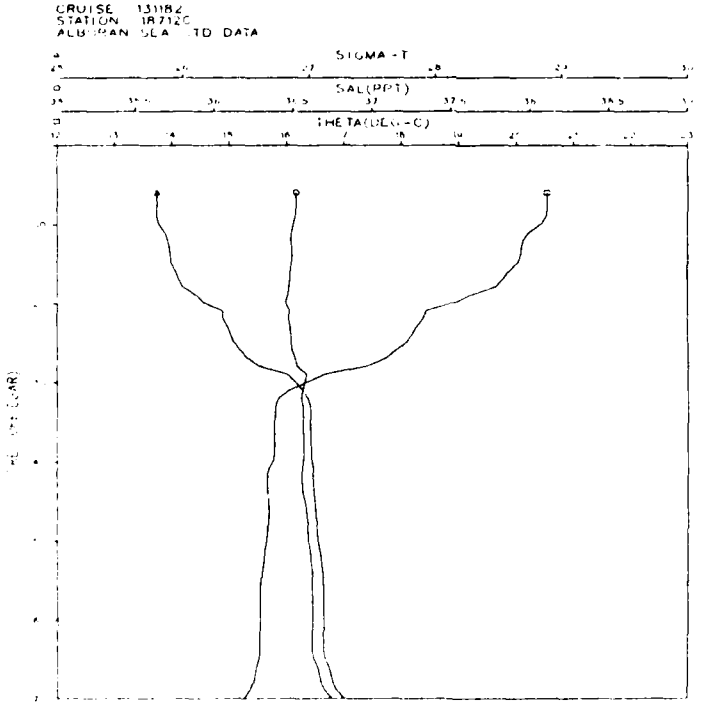
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 187120



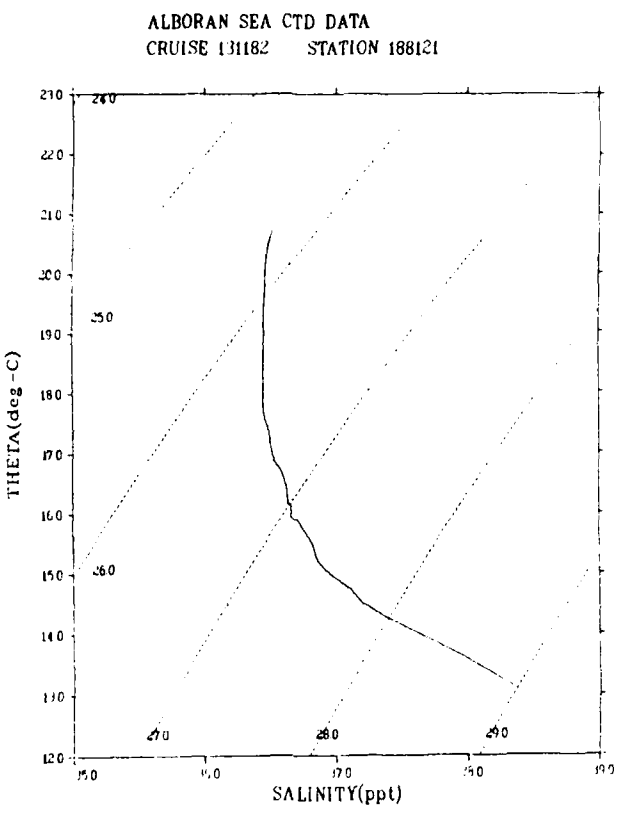


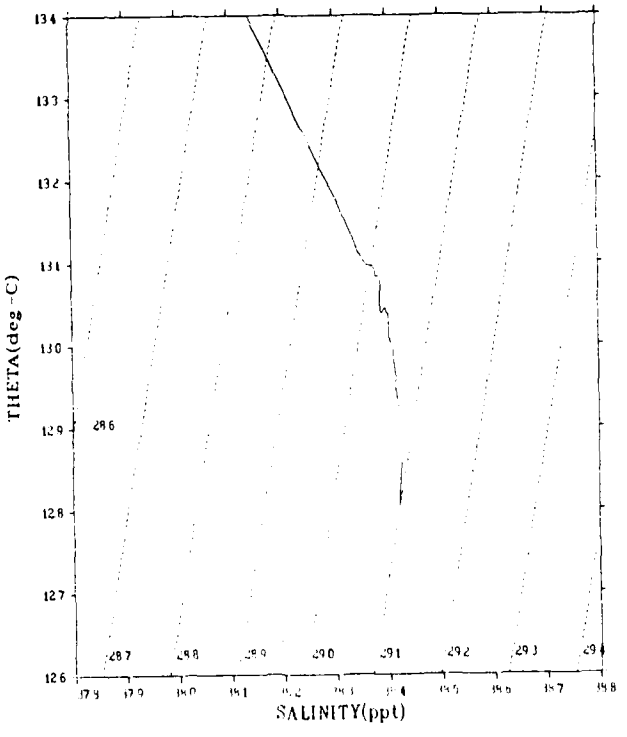
Figures 29a and 29b



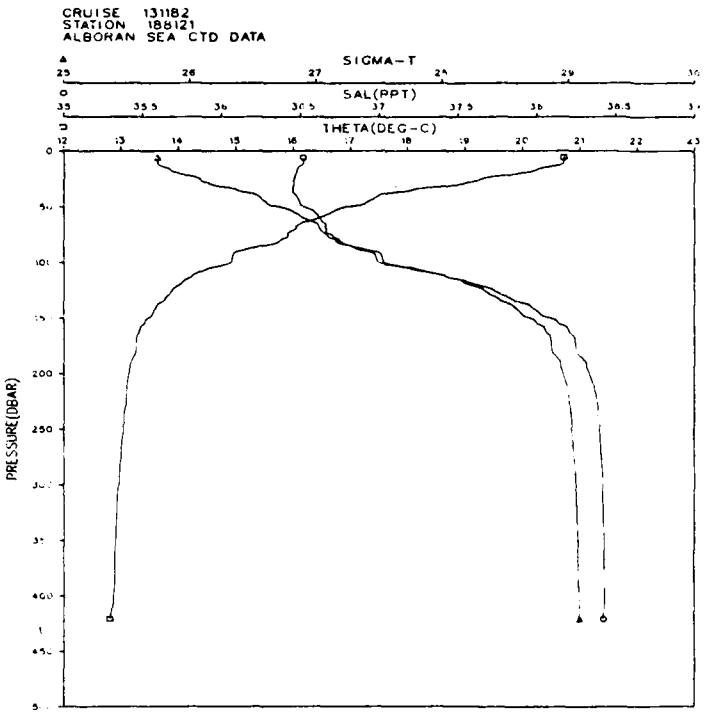


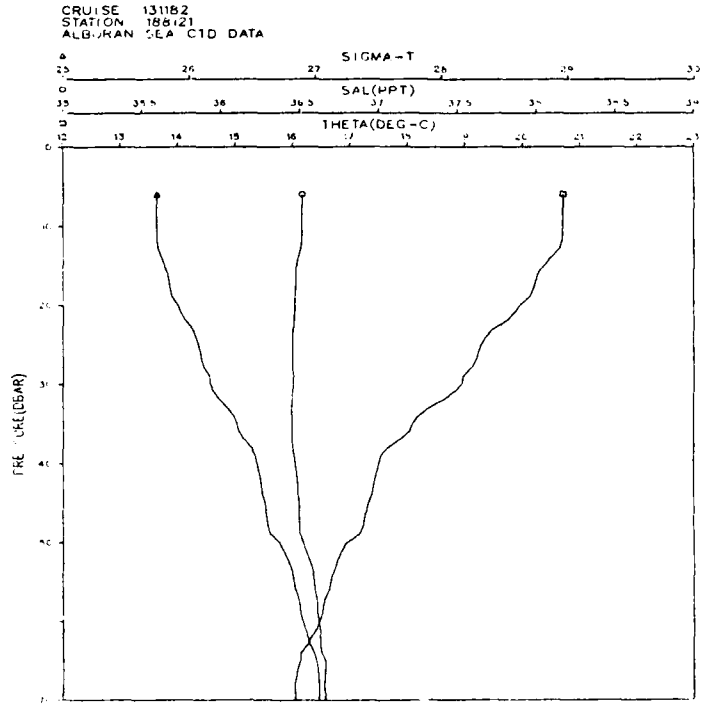
Figures 29c and 29d



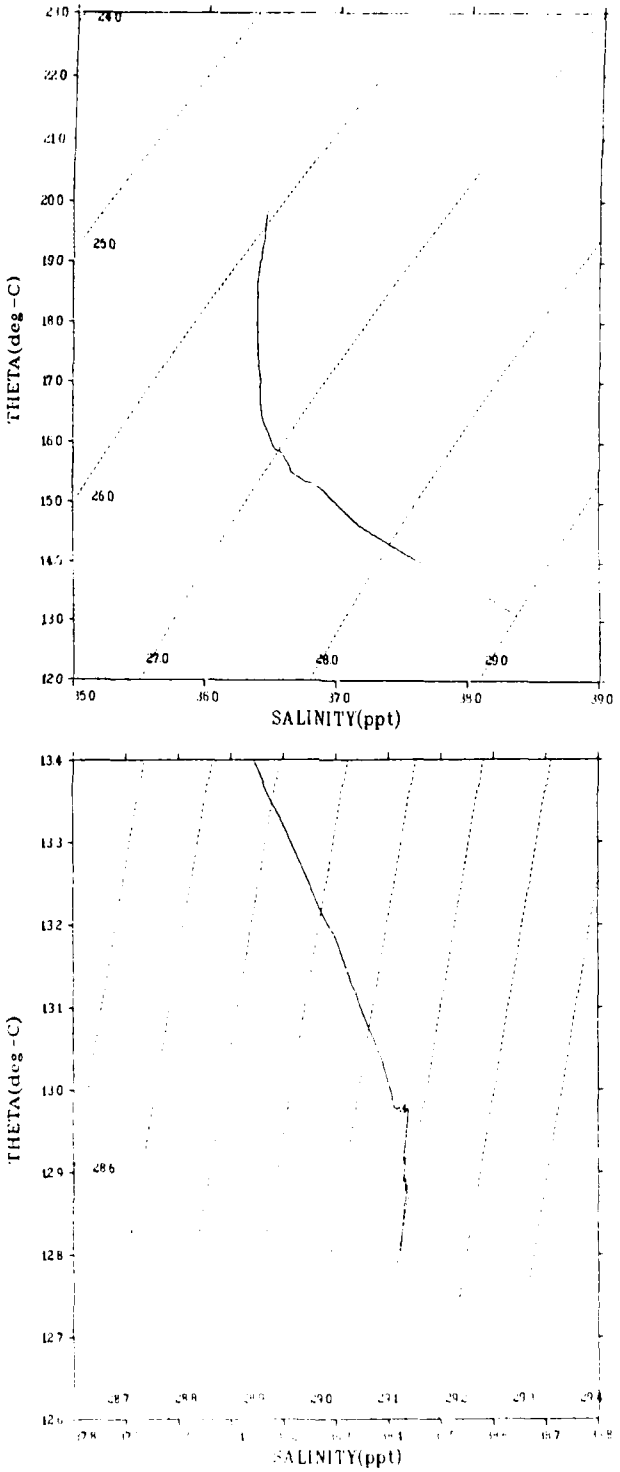


Figures 30a and 30b

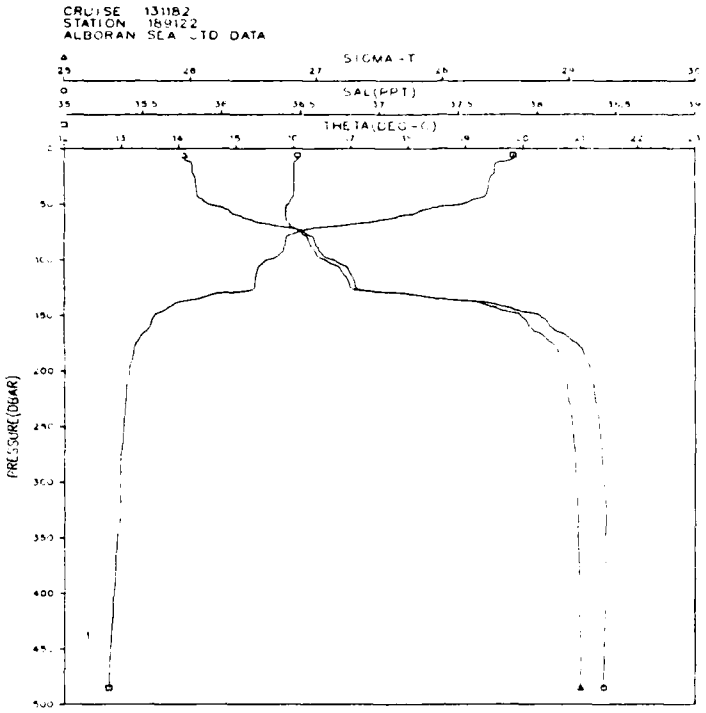


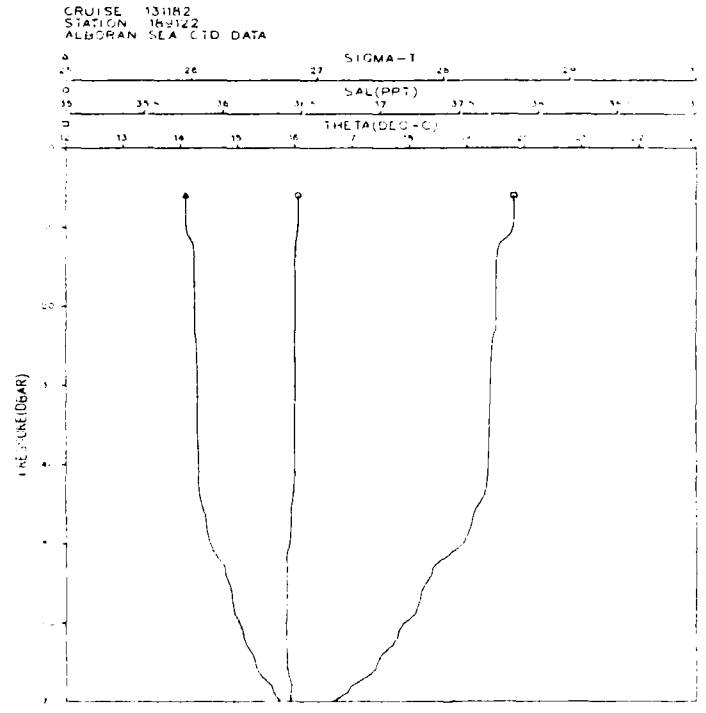


Figures 30c and 30d

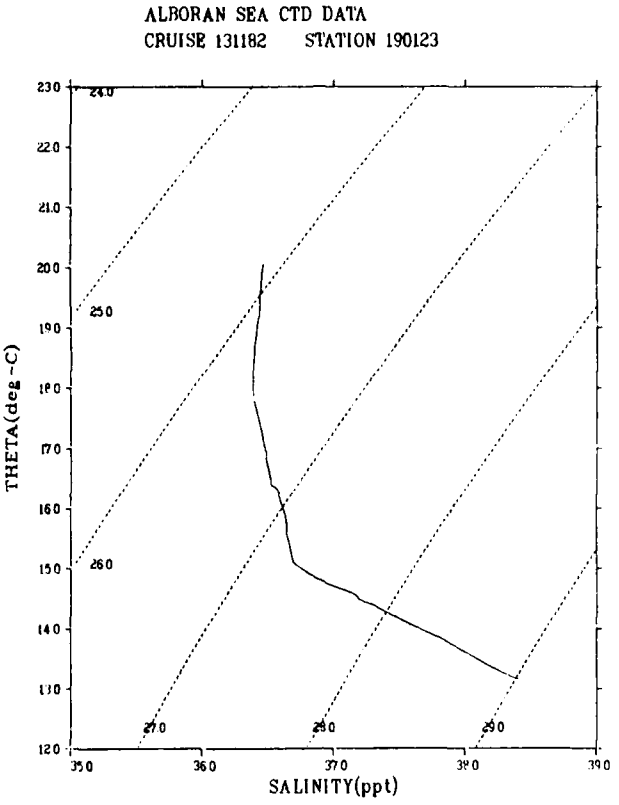


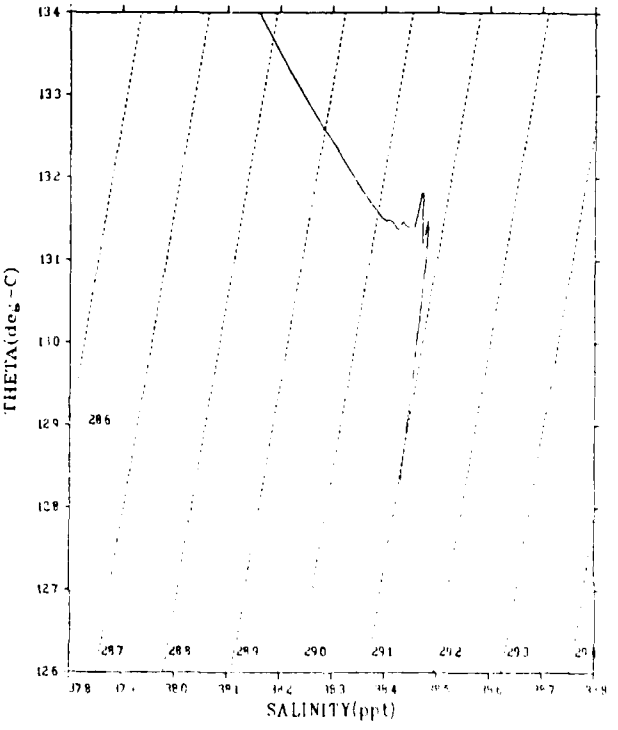
Figures 31a and 31b



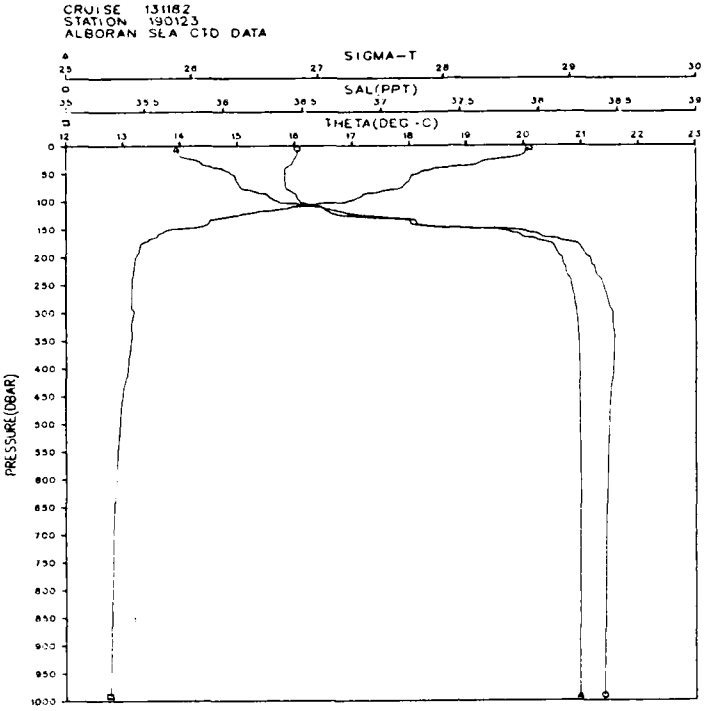


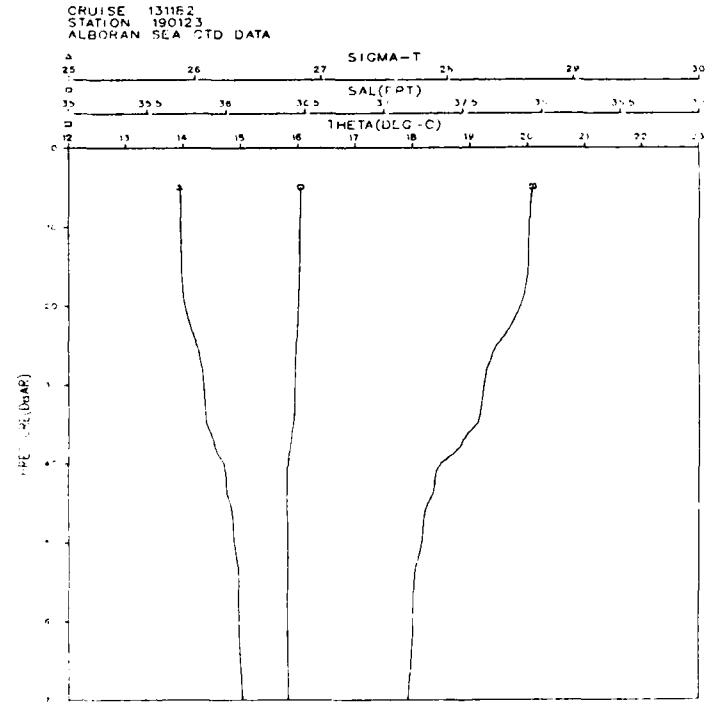
Figures 31c and 31d



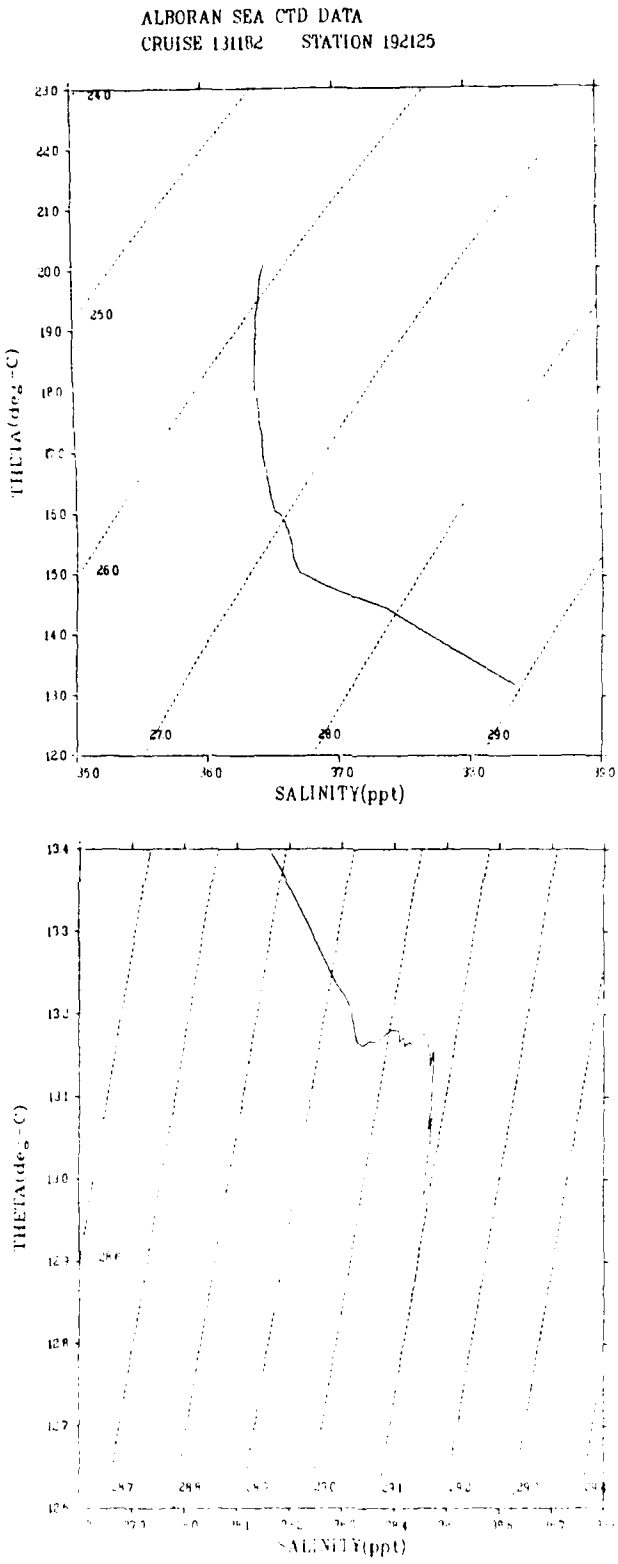


Figures 32a and 32b

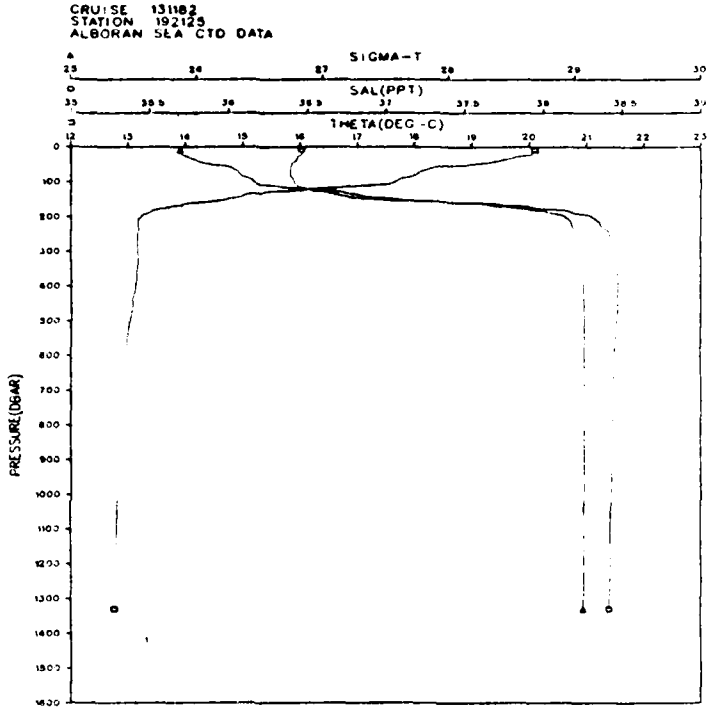


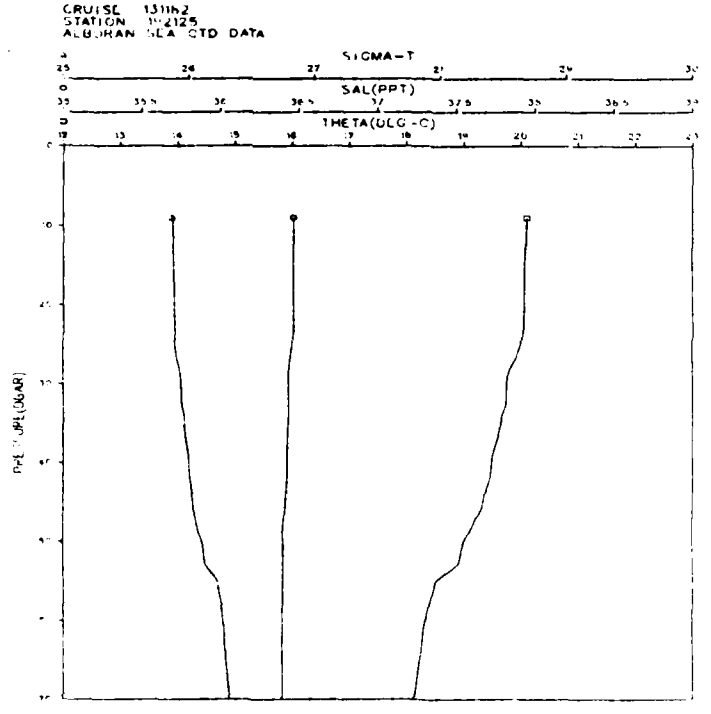


Figures 32c and 32d

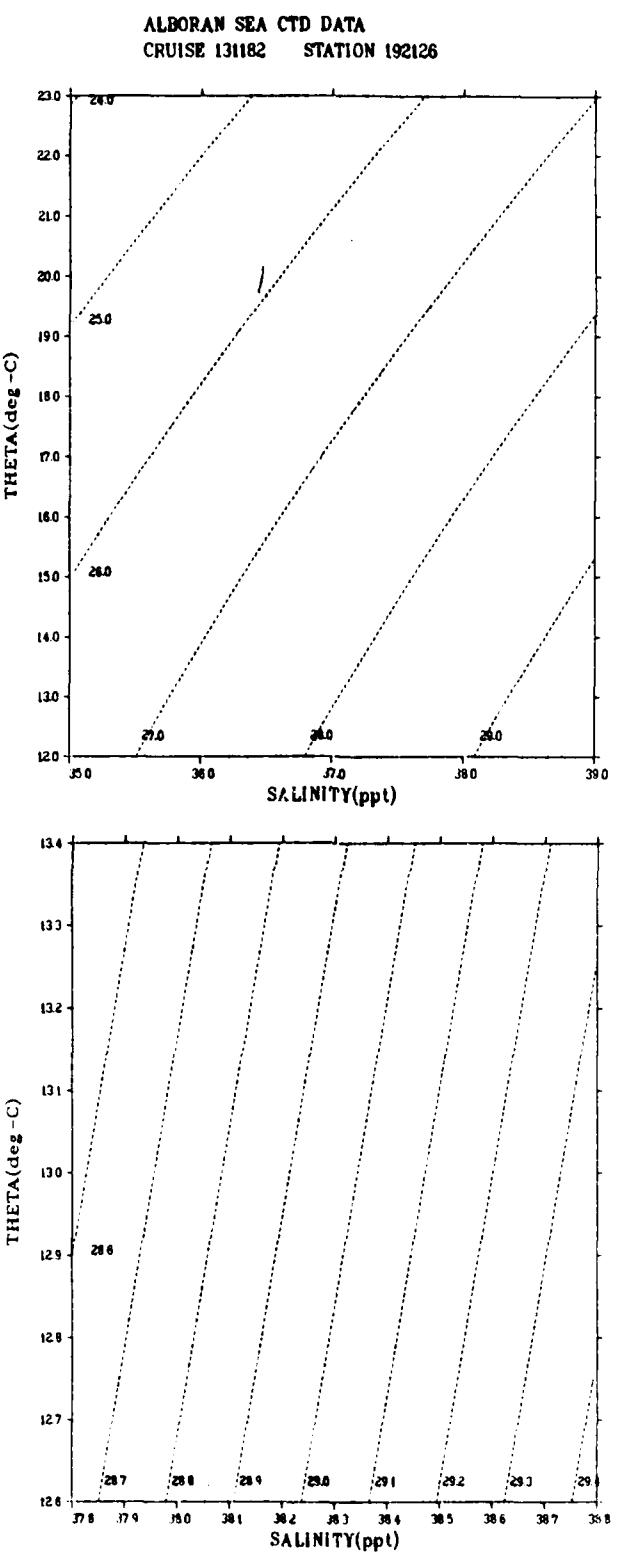


Figures 33a and 33b

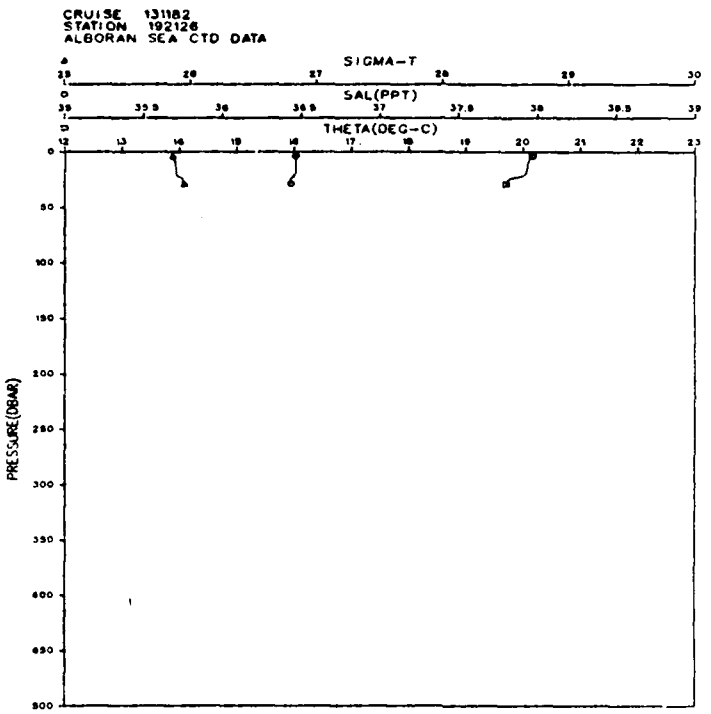


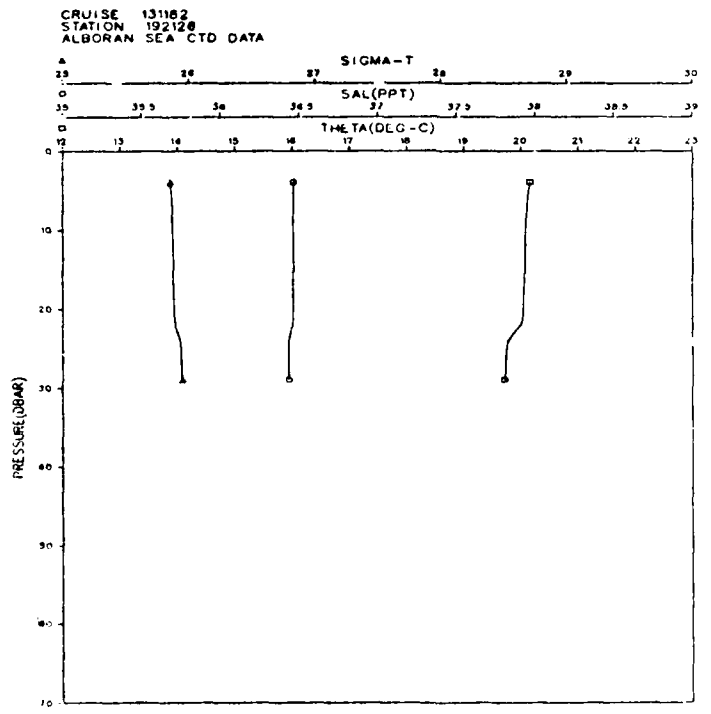


Figures 33c and 33d



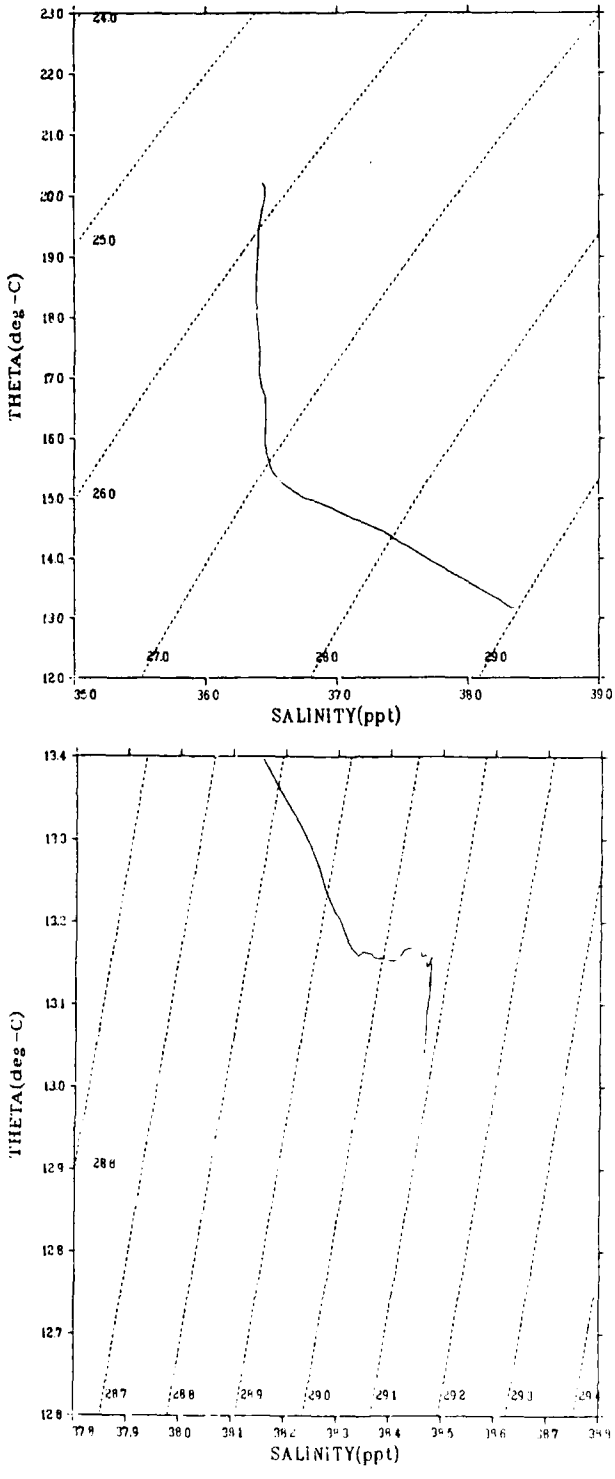
Figures 34a and 34b



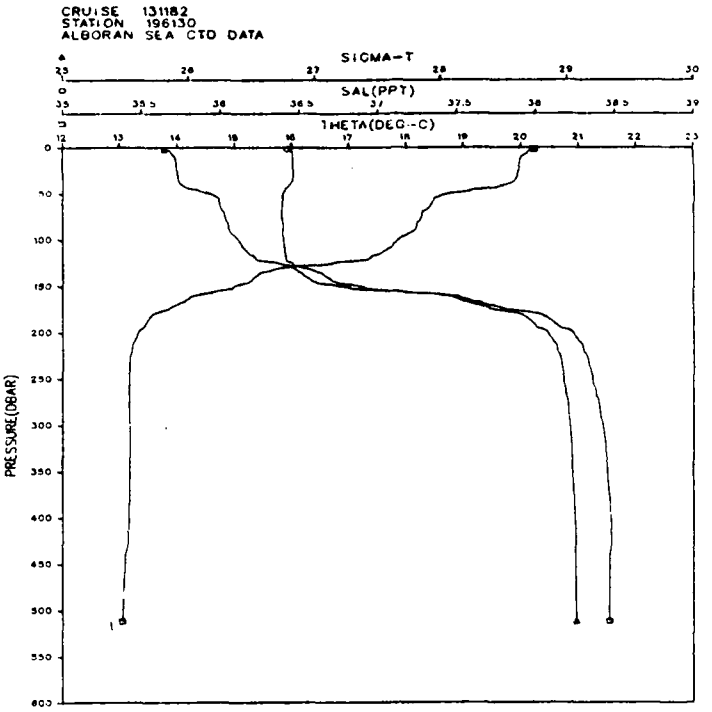


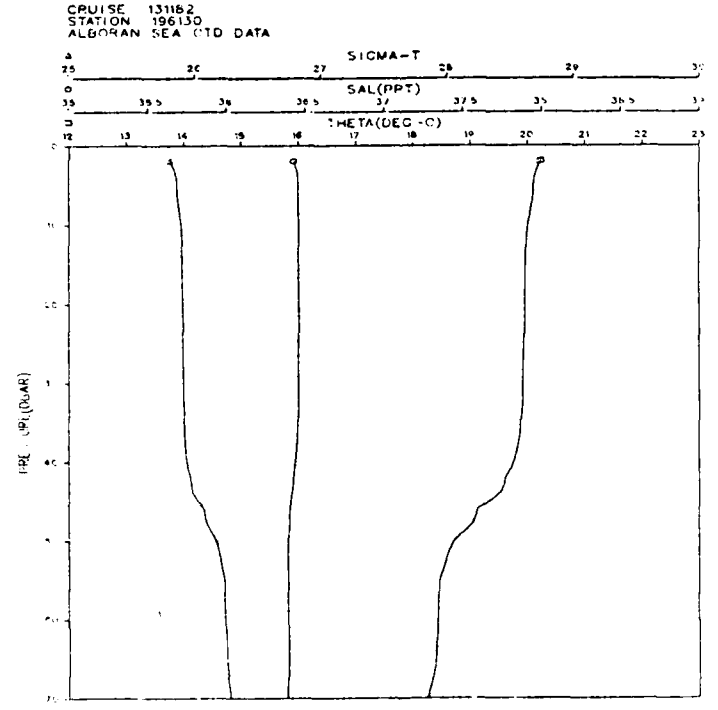
Figures 34c and 34d

ALBORAN SEA CTD DATA
CRUISE 131182 STATION 196130

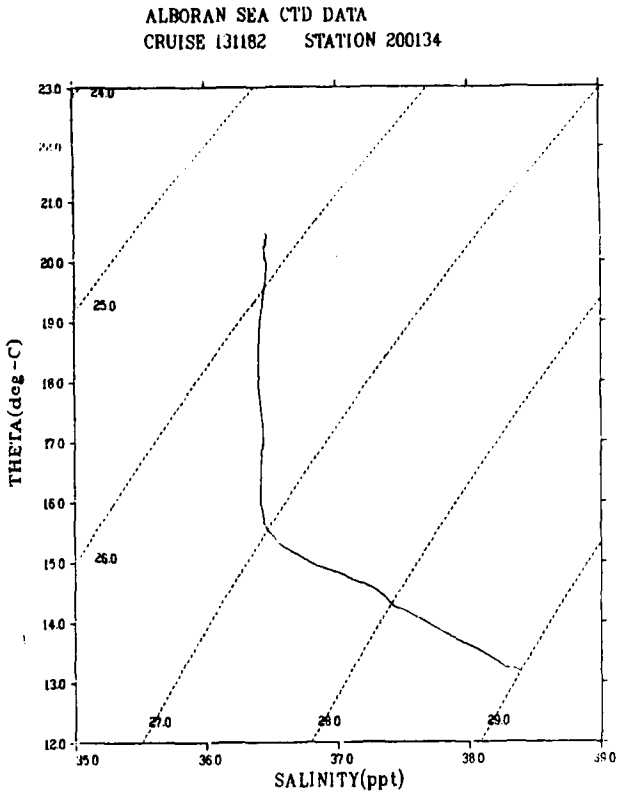


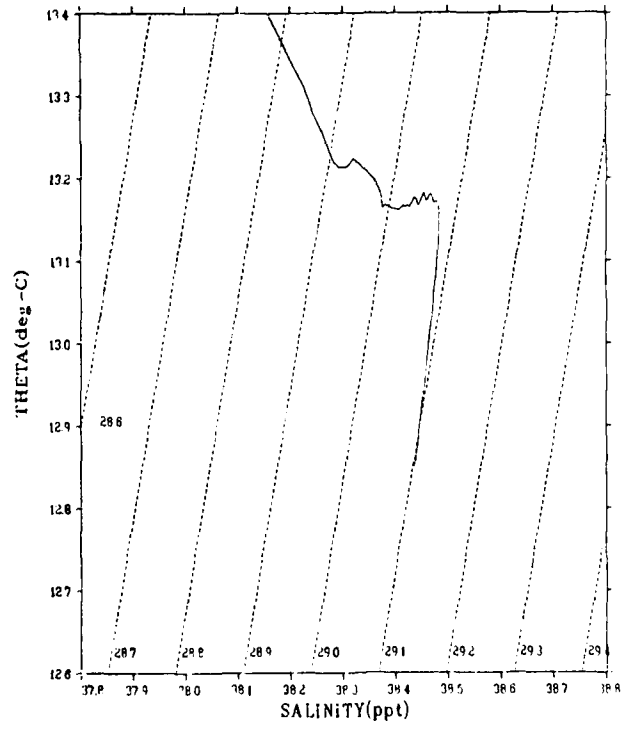
Figures 35a and 35b



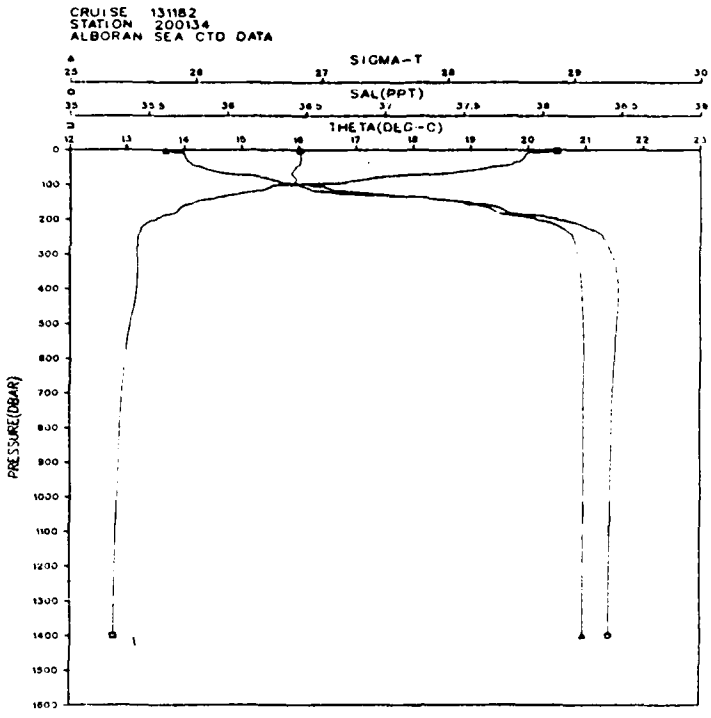


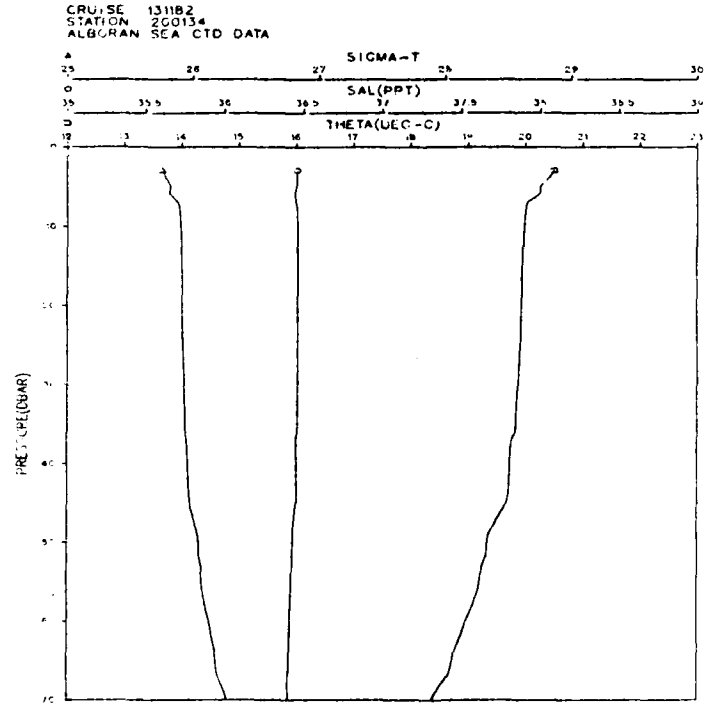
Figures 35c and 35d



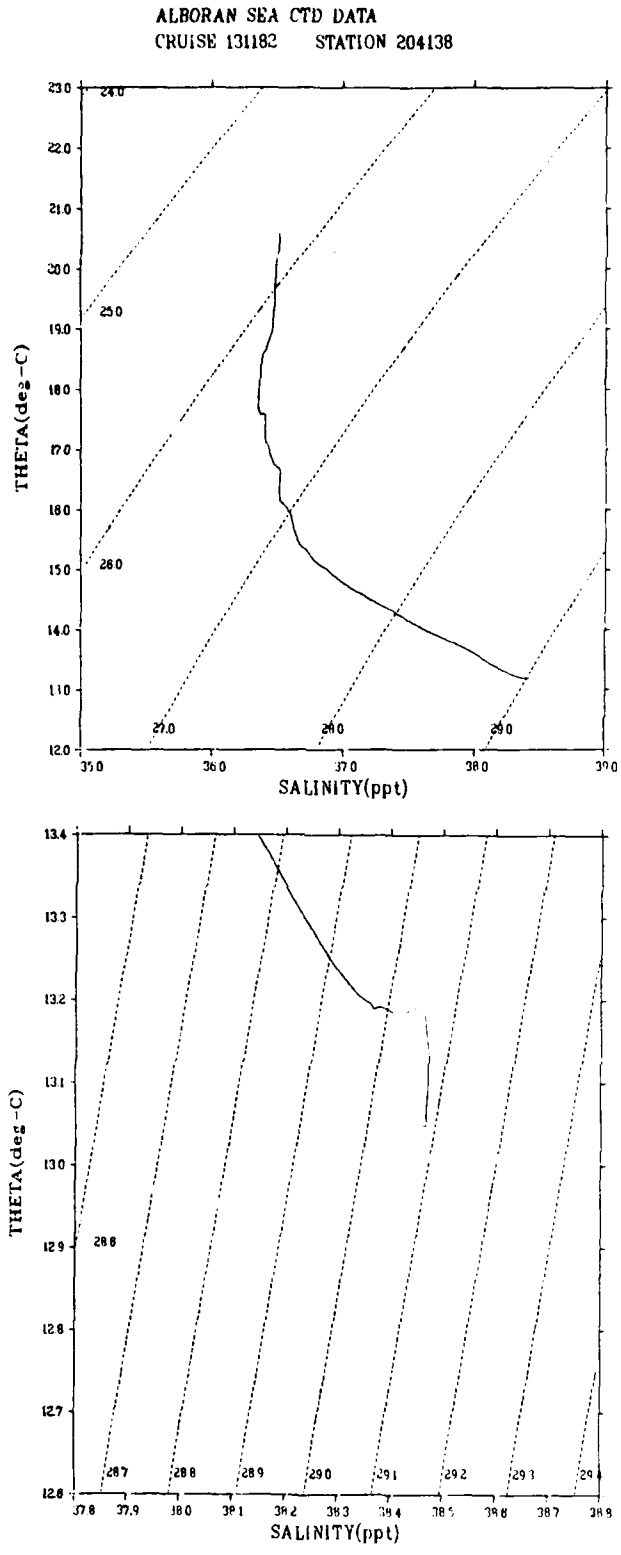


Figures 36a and 36b

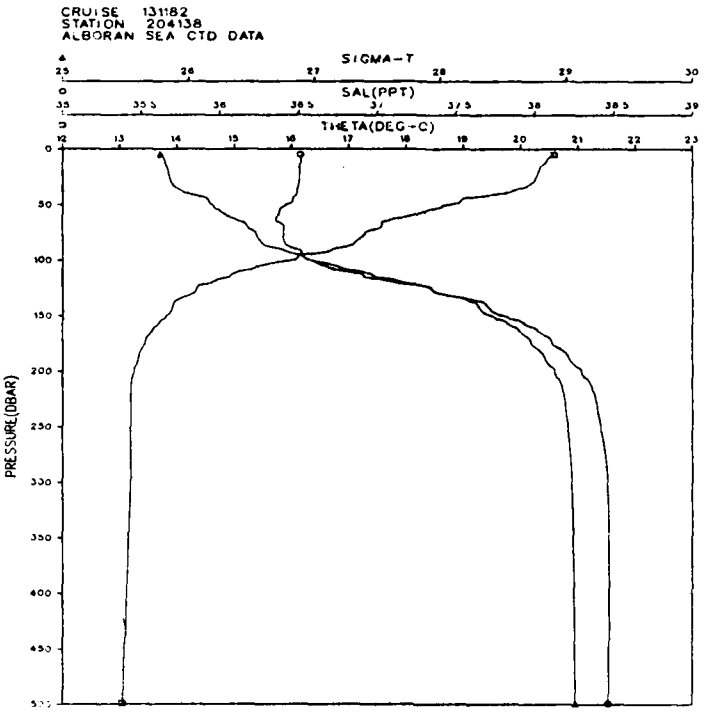


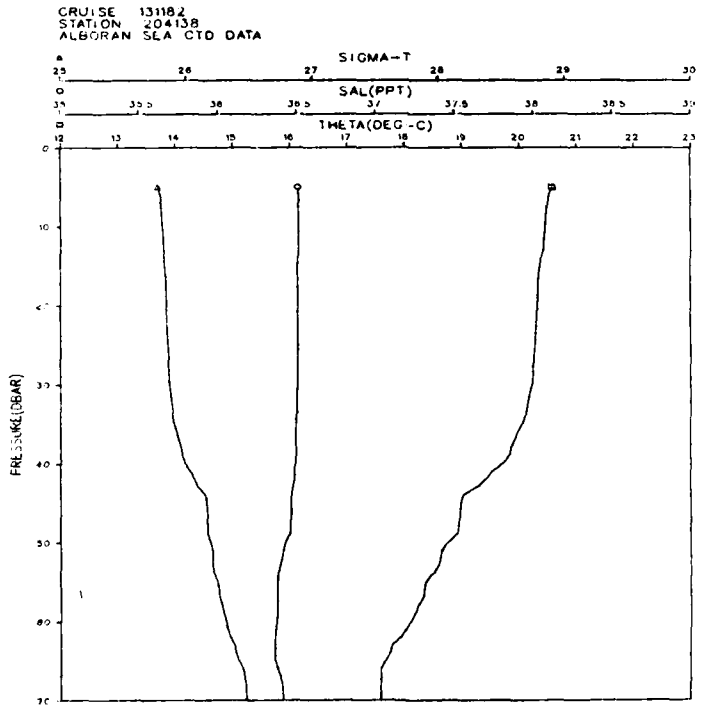


Figures 36c and 36d

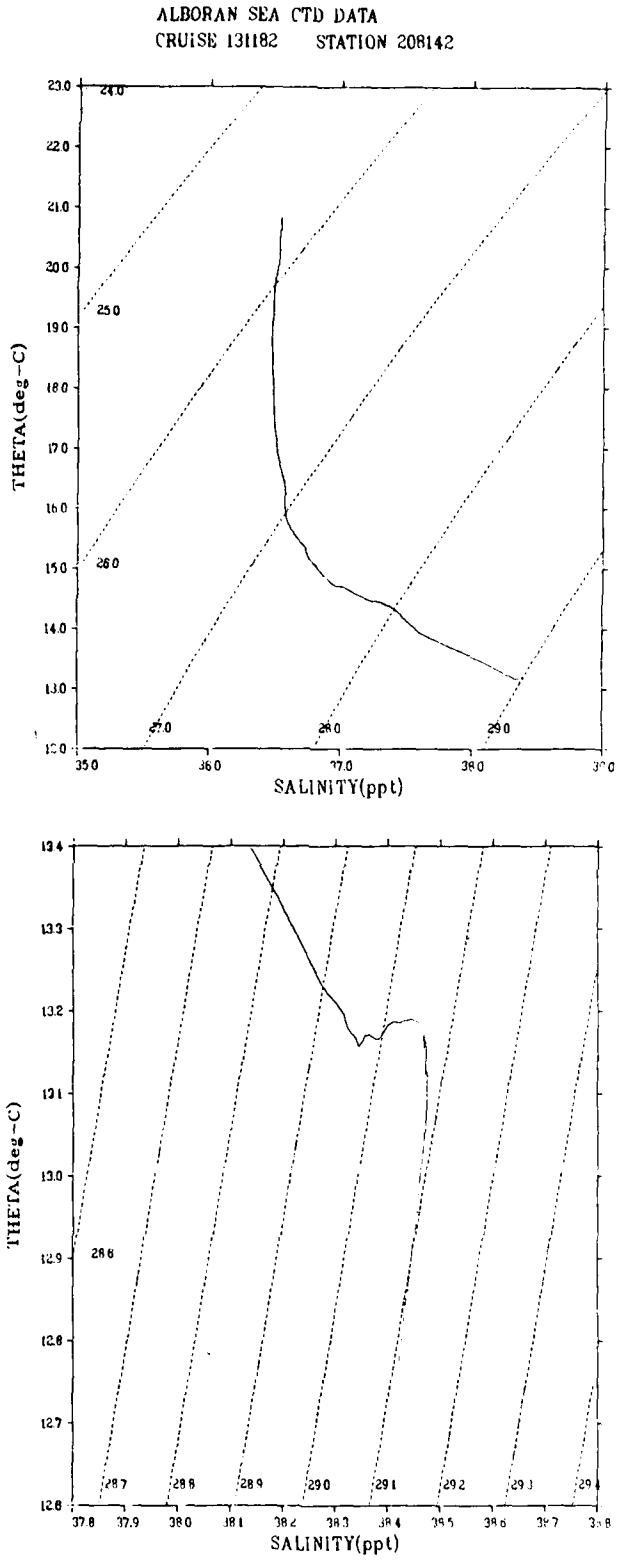


Figures 37a and 37b

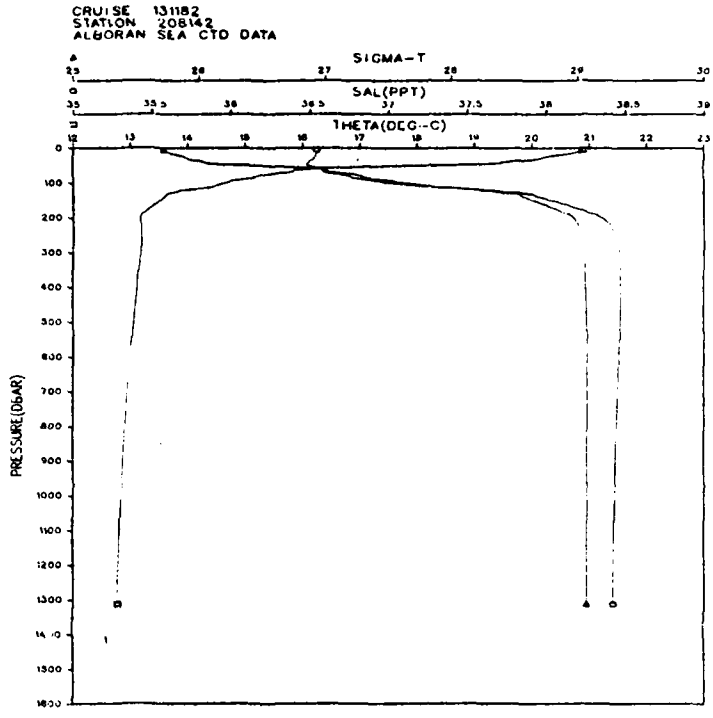


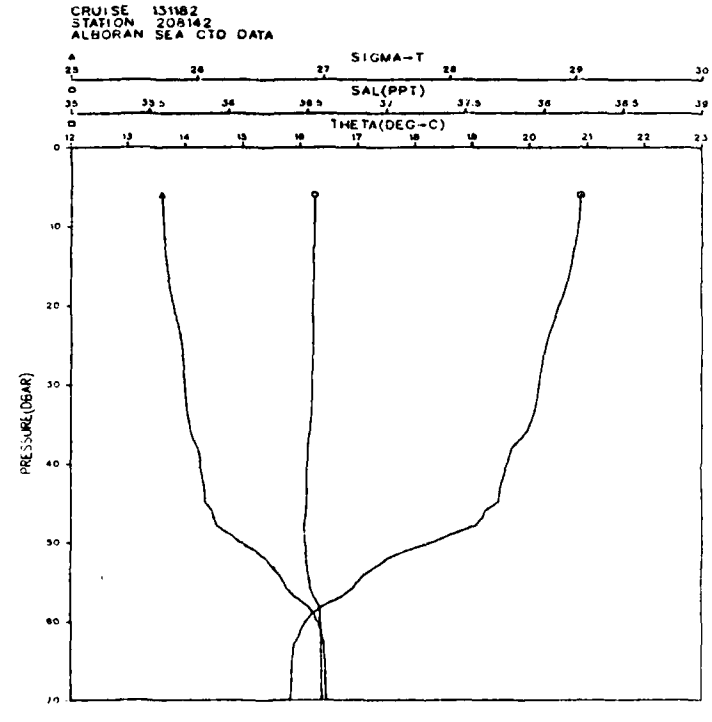


Figures 37c and 37d



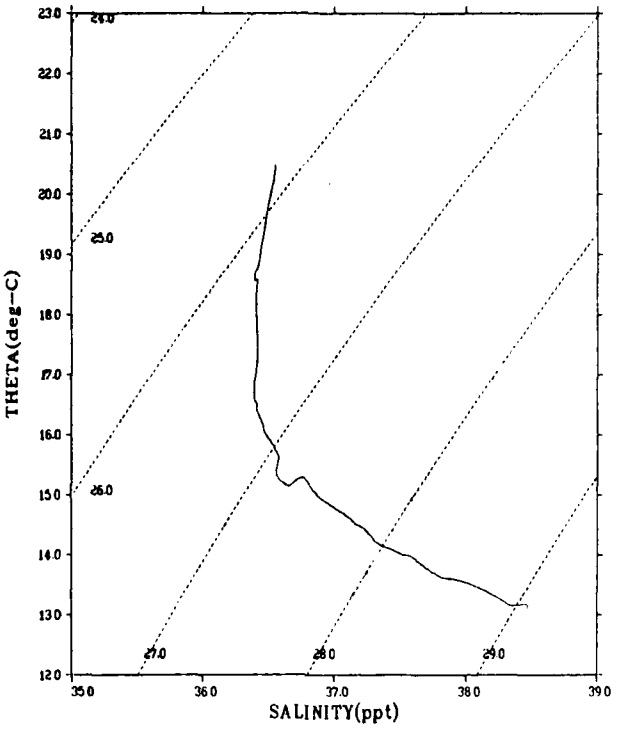
Figures 38a and 38b

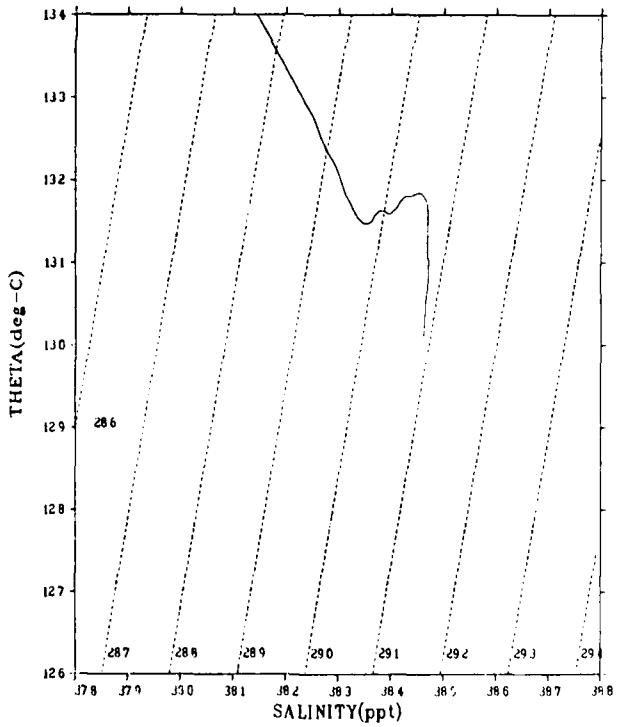




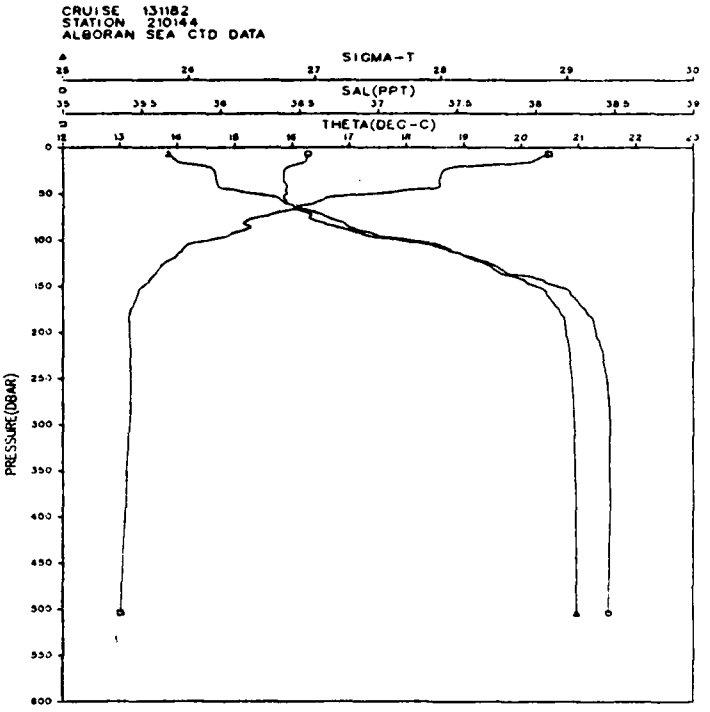
Figures 38c and 38d

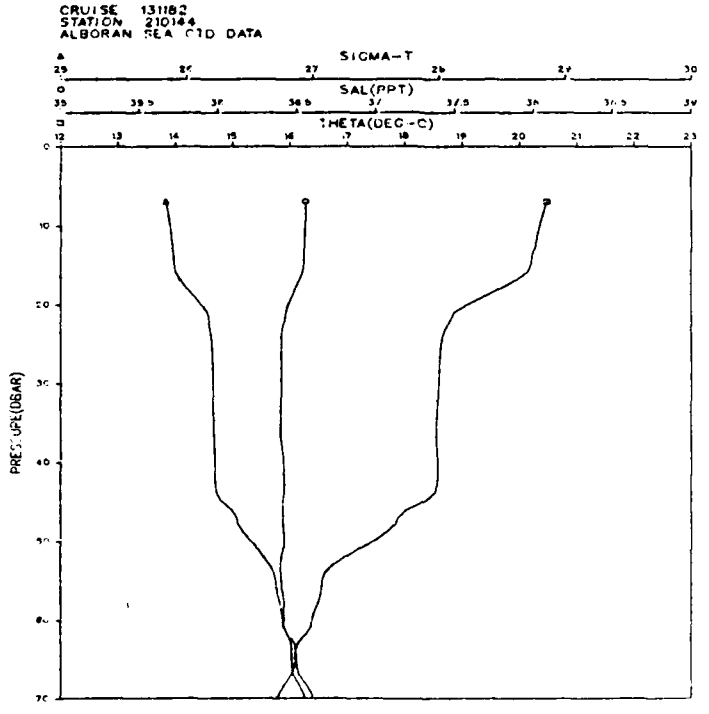
ALBORAN SEA CTD DATA
CRUISE 131182 STATION 210144



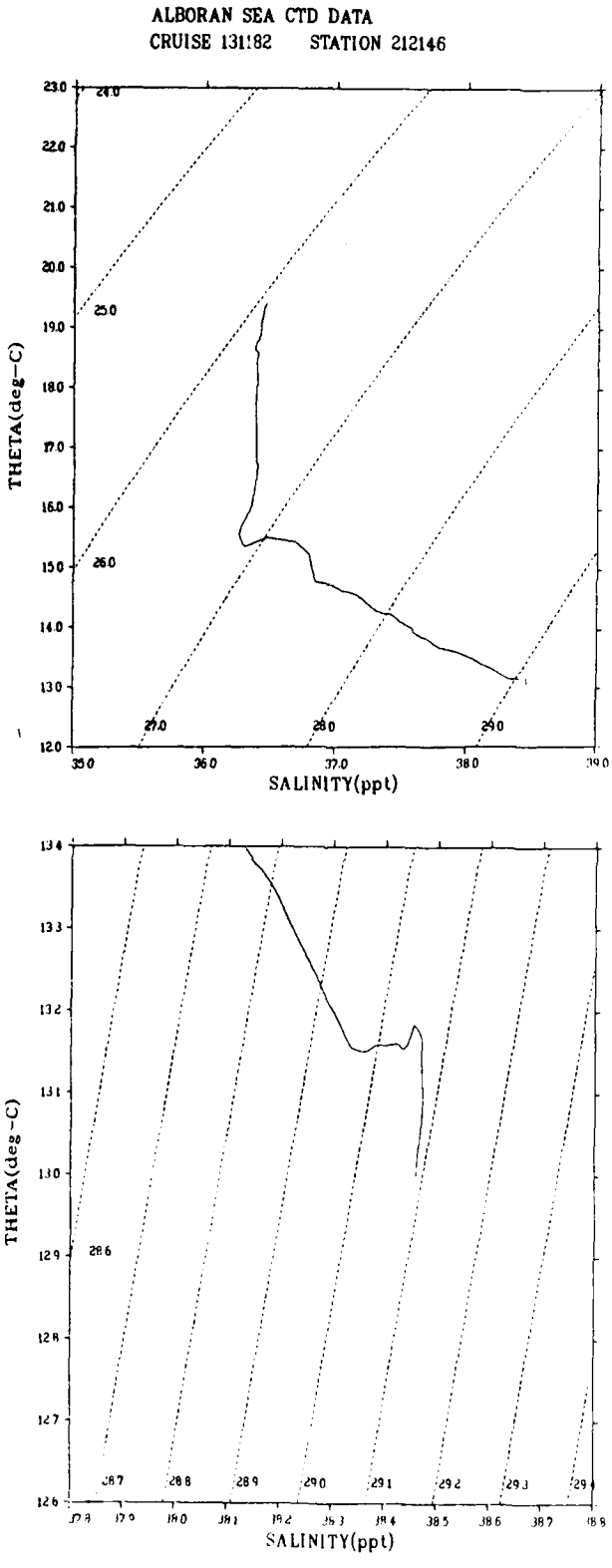


Figures 39a and 39b

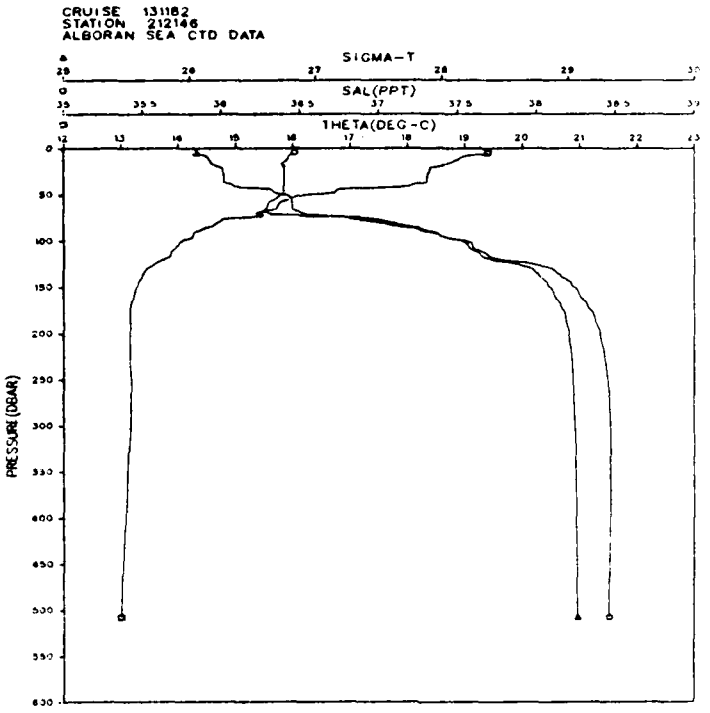


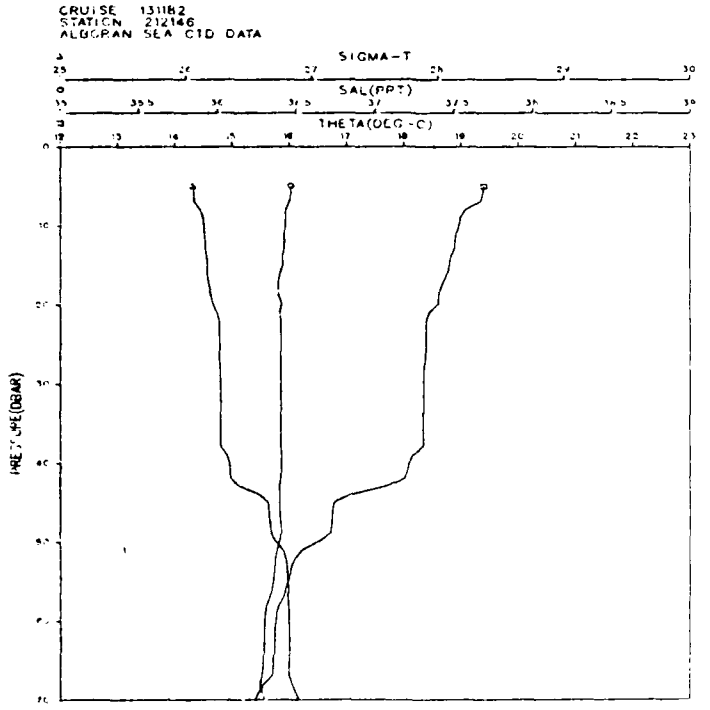


Figures 39c and 39d

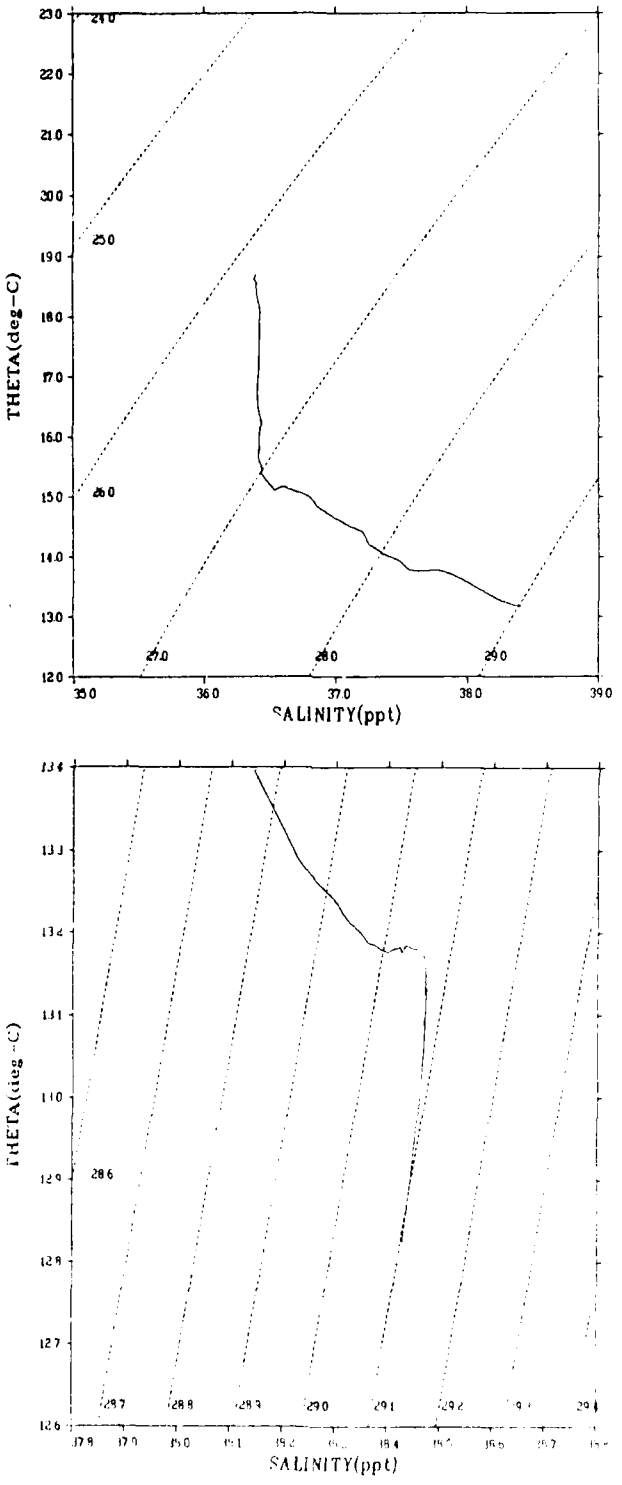


Figures 40a and 40b





Figures 40c and 40d



Figures 41a and 41b

AD-A143 500 HYDROGRAPHIC MEASUREMENTS IN THE WESTERN ARLBORAN SEA OCTOBER 1982(U) NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY NSTL STATION MS T H KINDER ET AL. APR 84 2/2

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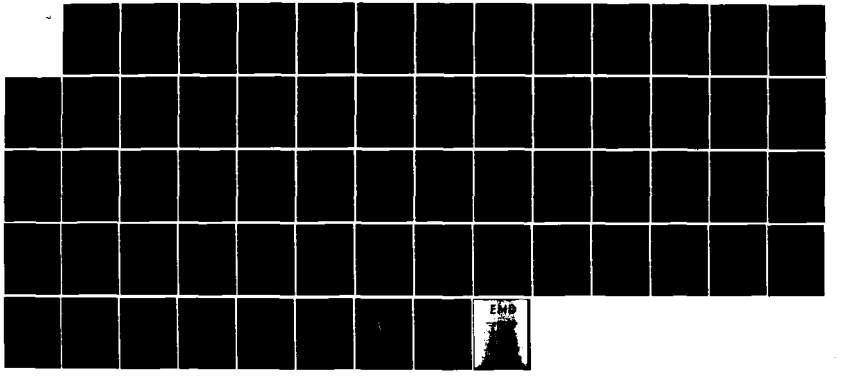
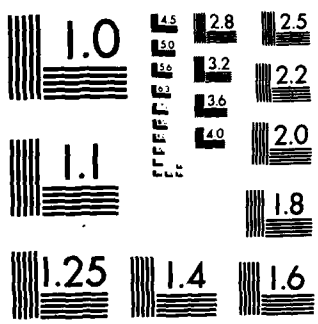
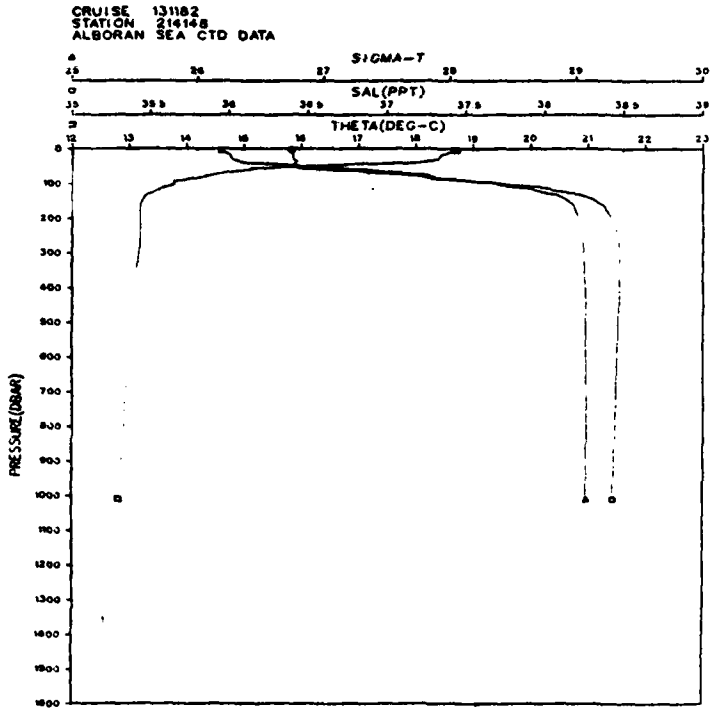
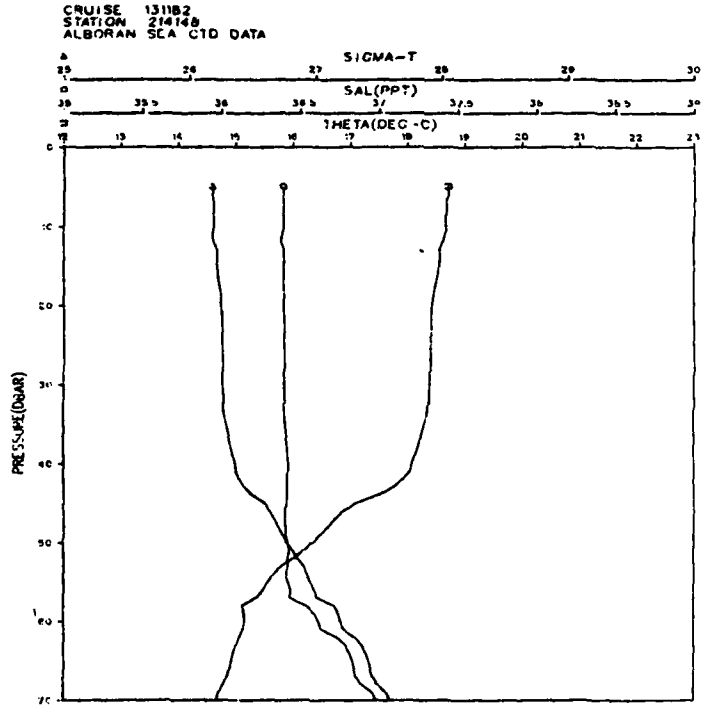
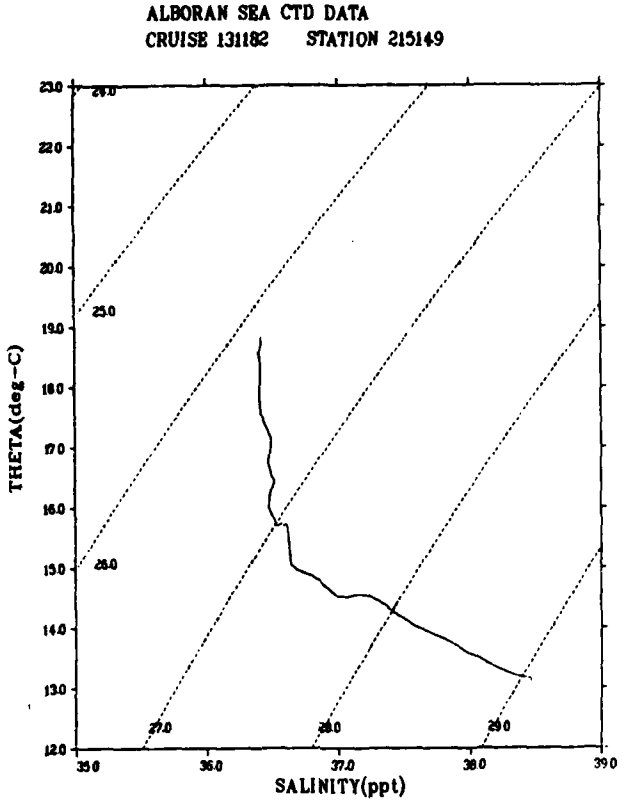


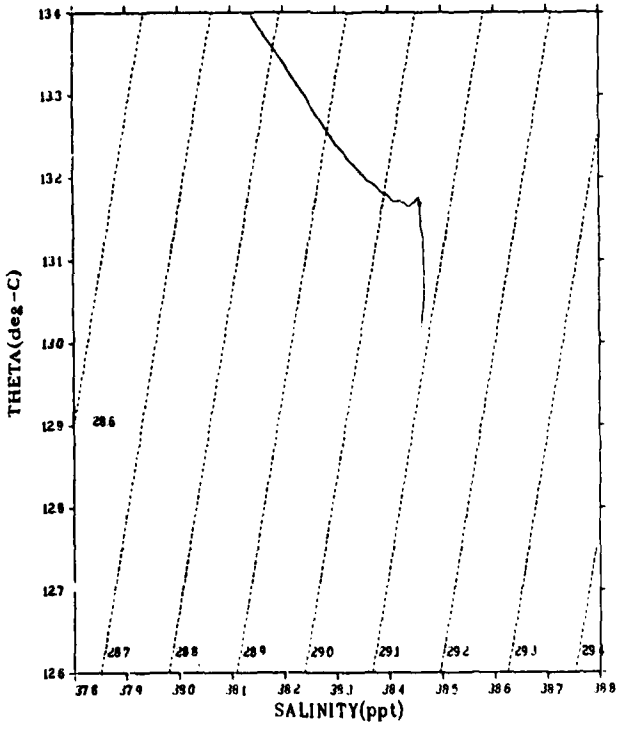




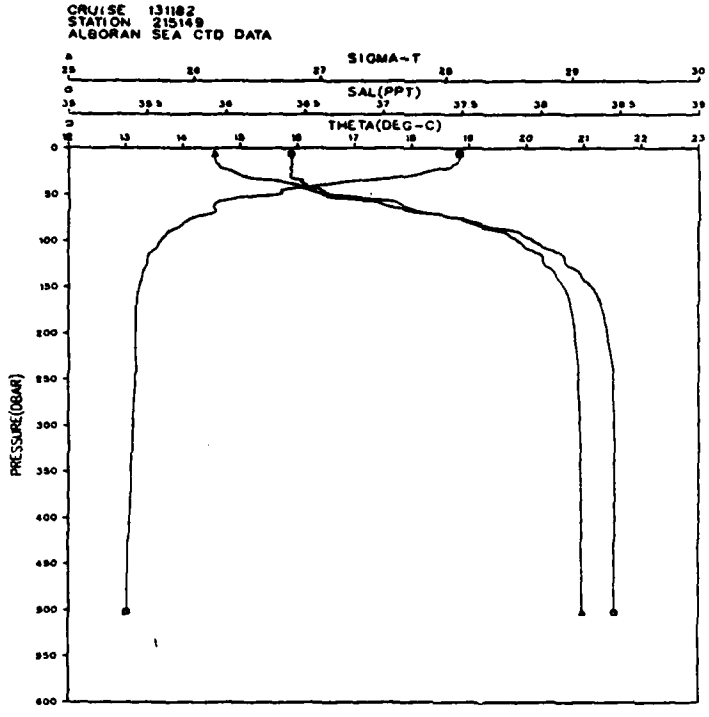


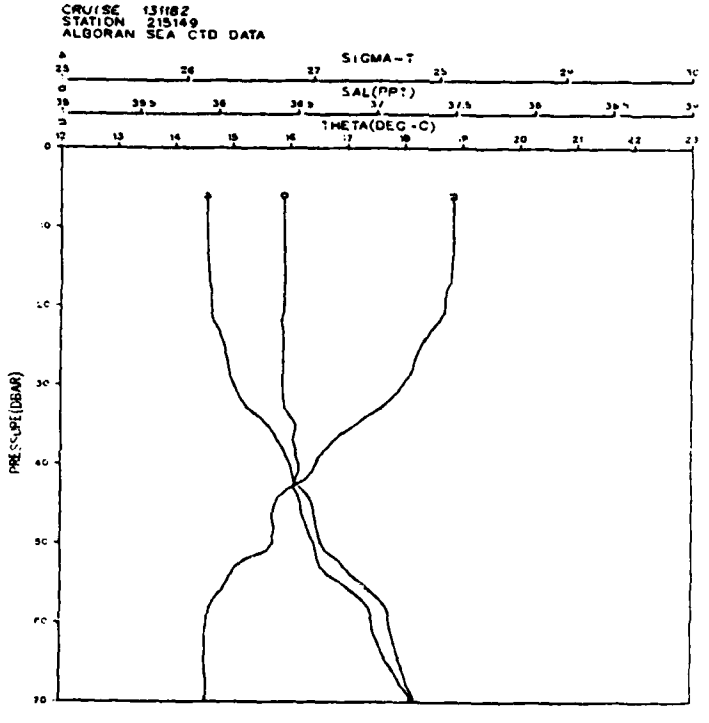
Figures 41c and 41d



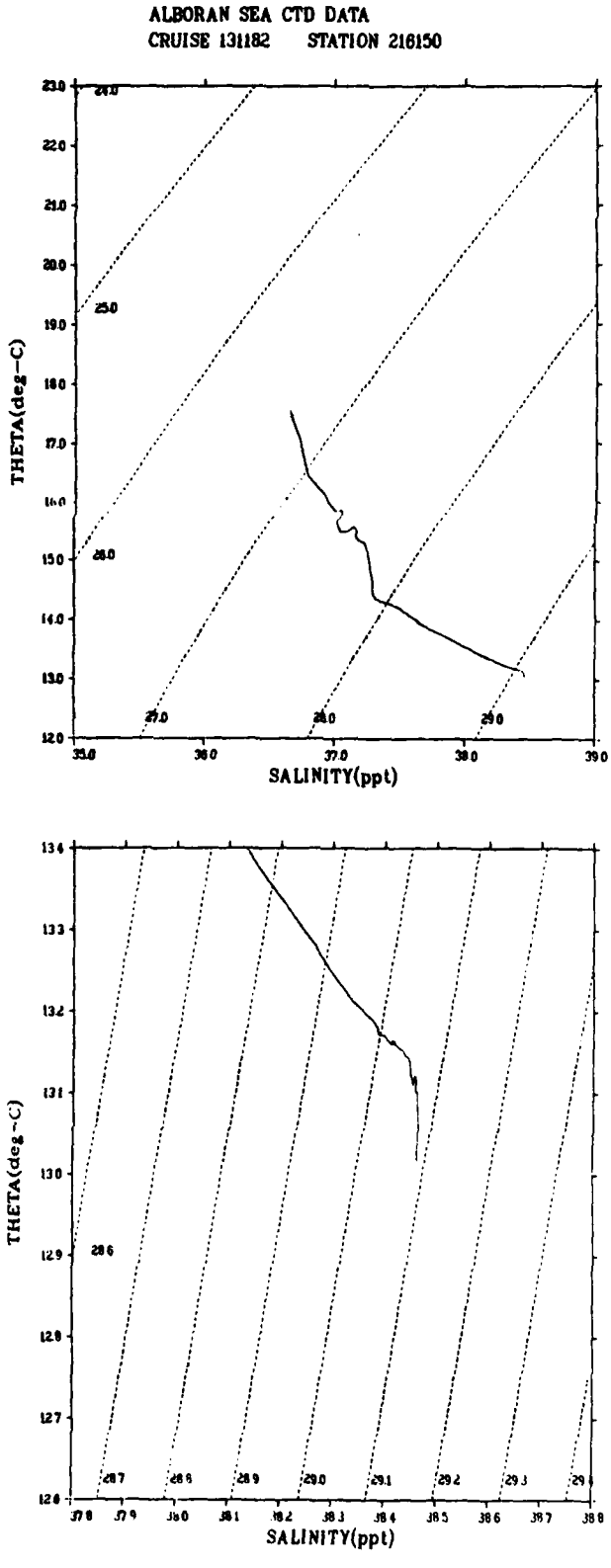


Figures 42a and 42b

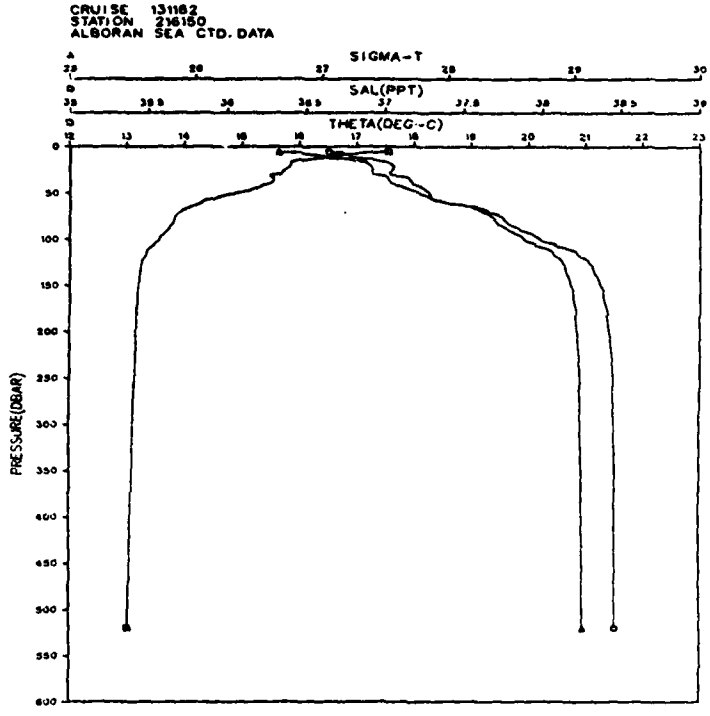


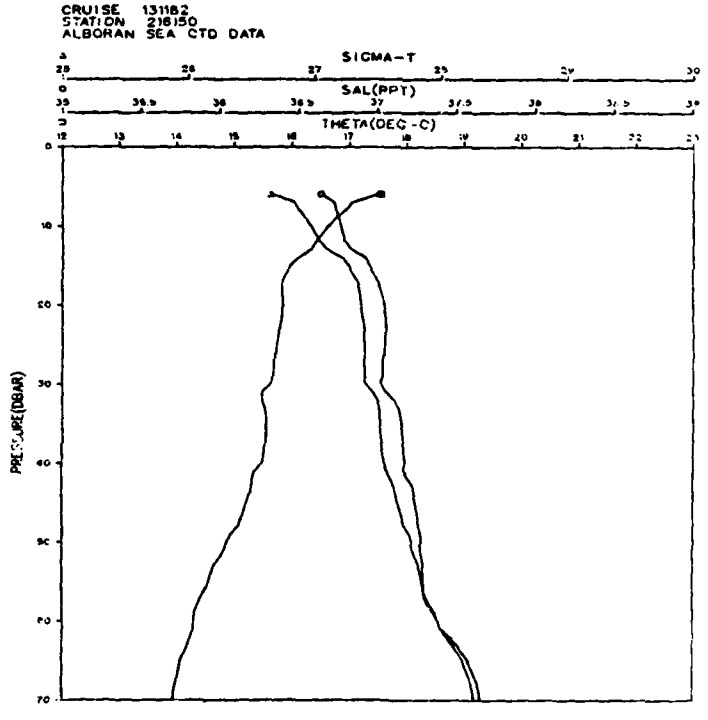


Figures 42c and 42d

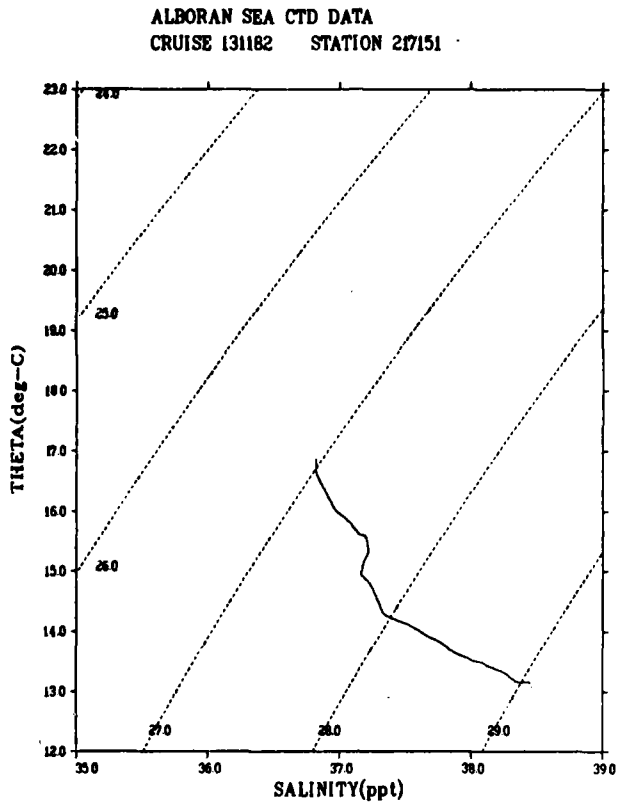


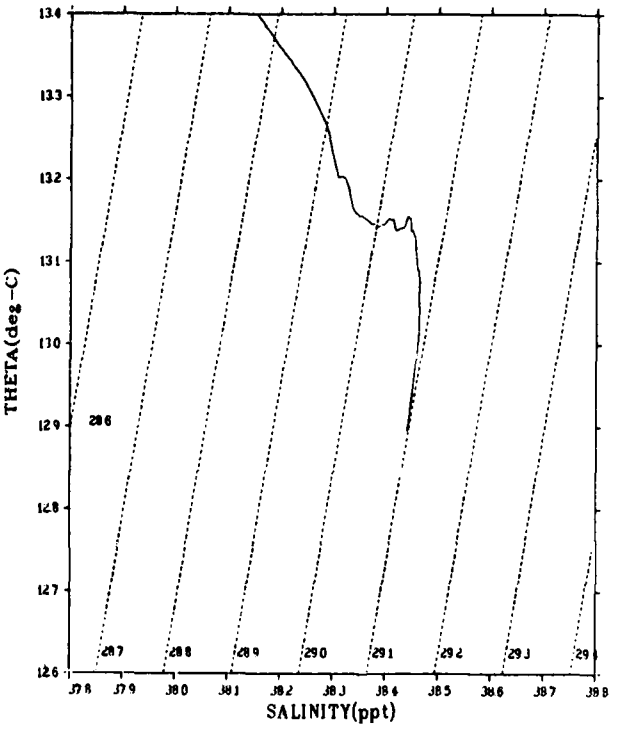
Figures 43a and 43b



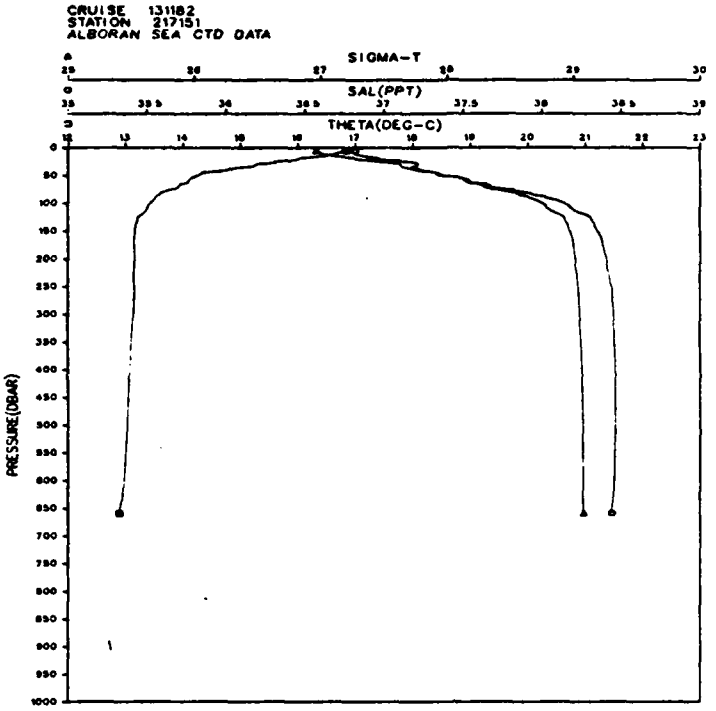


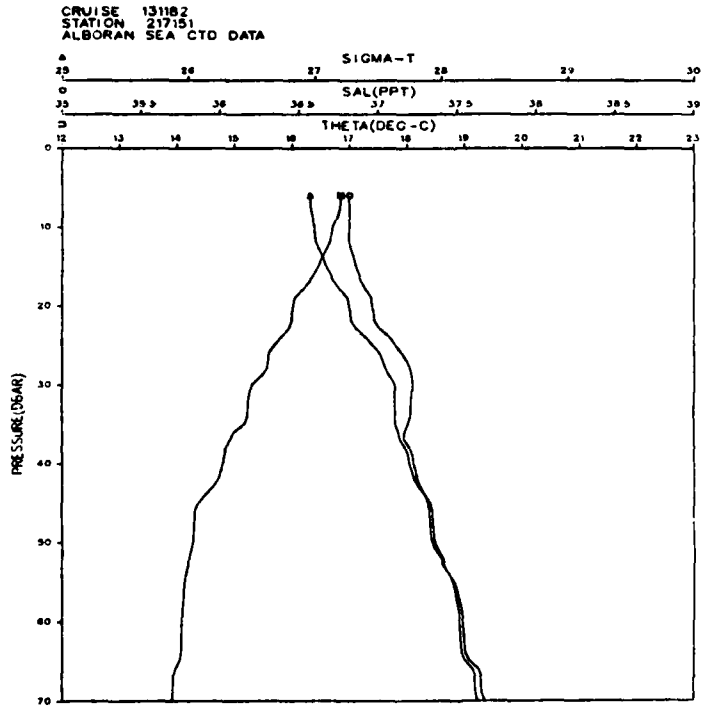
Figures 43c and 43d



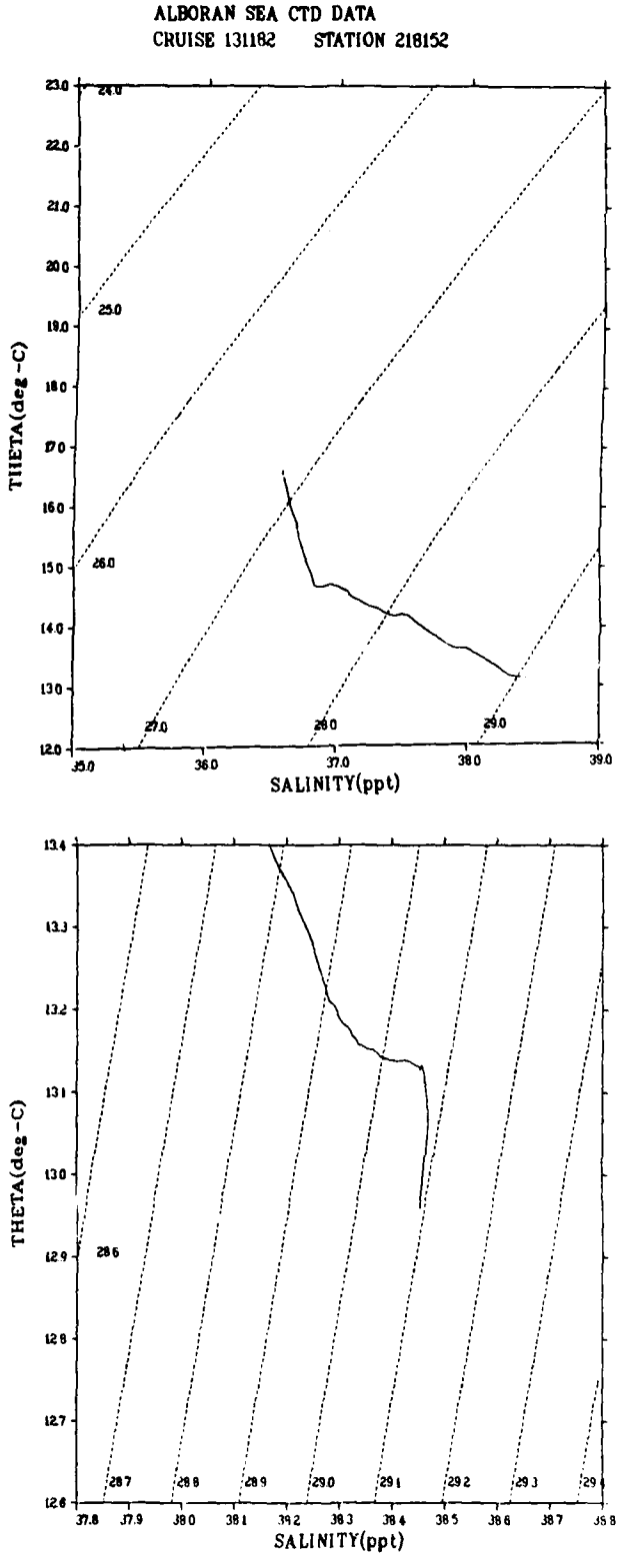


Figures 44a and 44b

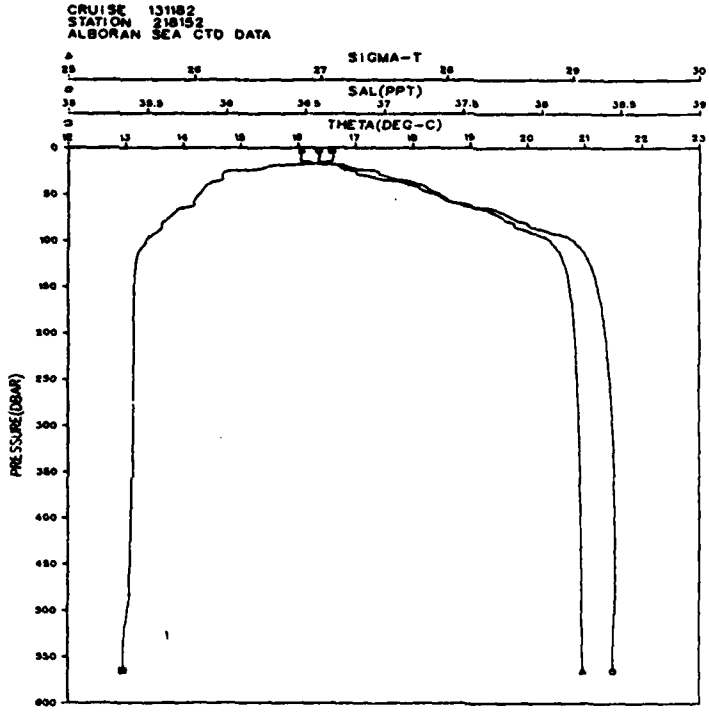


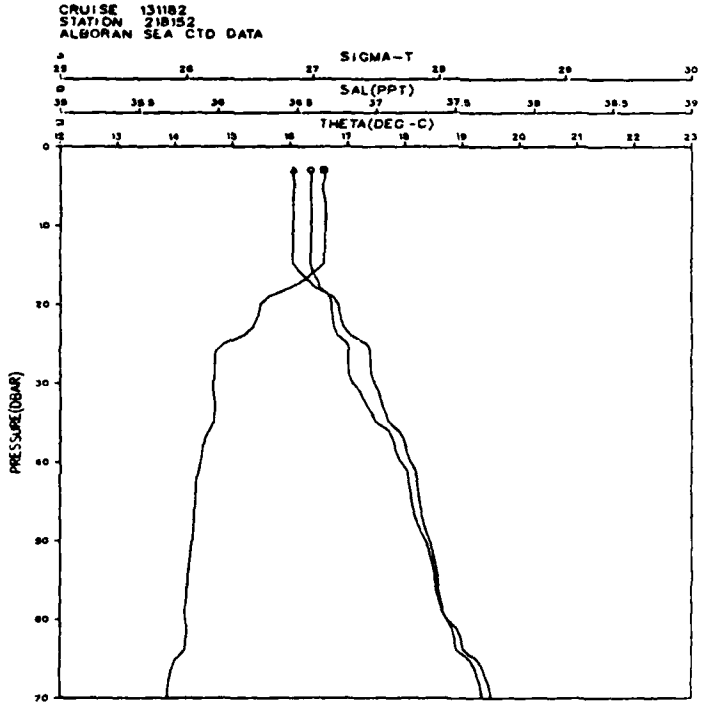


Figures 44c and 44d

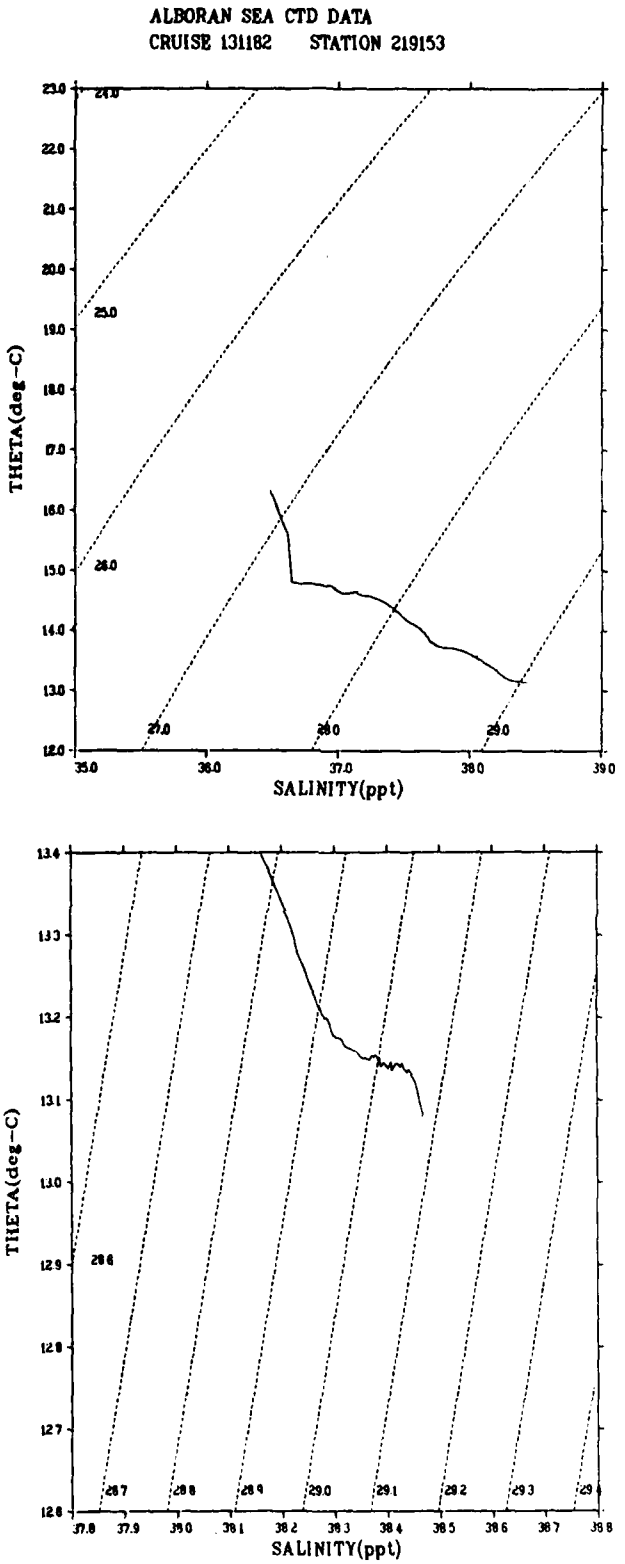


Figures 45a and 45b

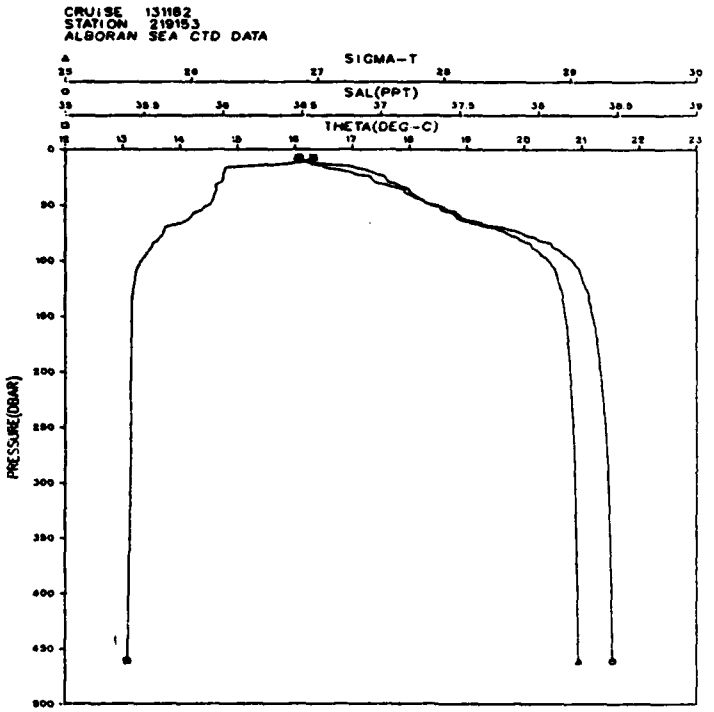


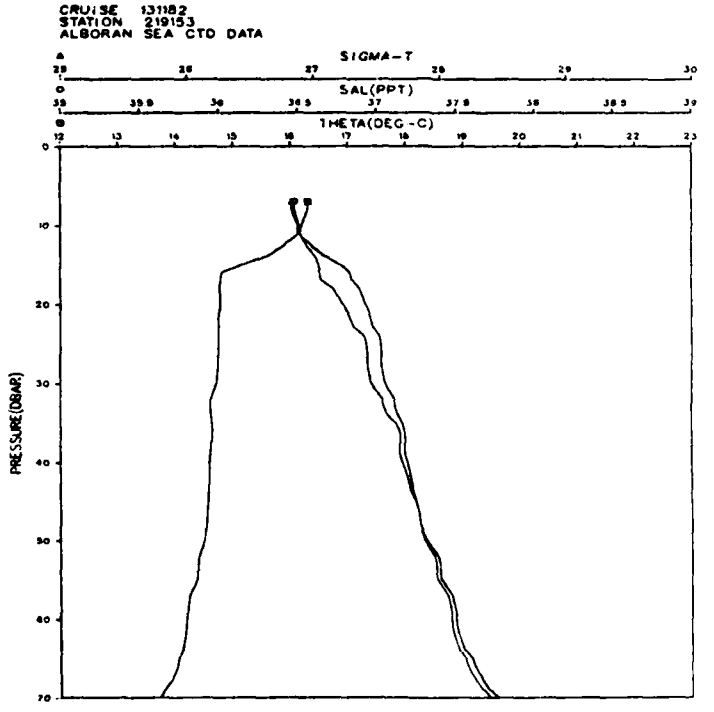


Figures 45c and 45d

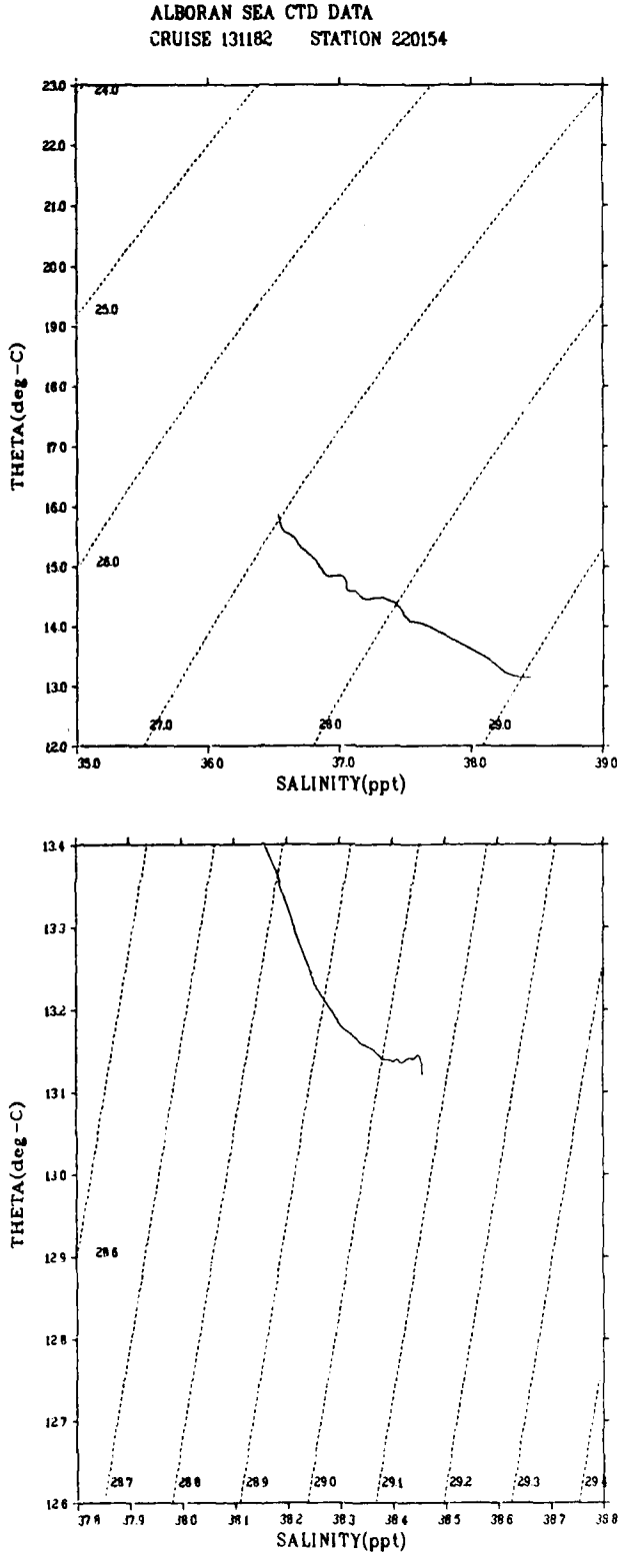


Figures 46a and 46b

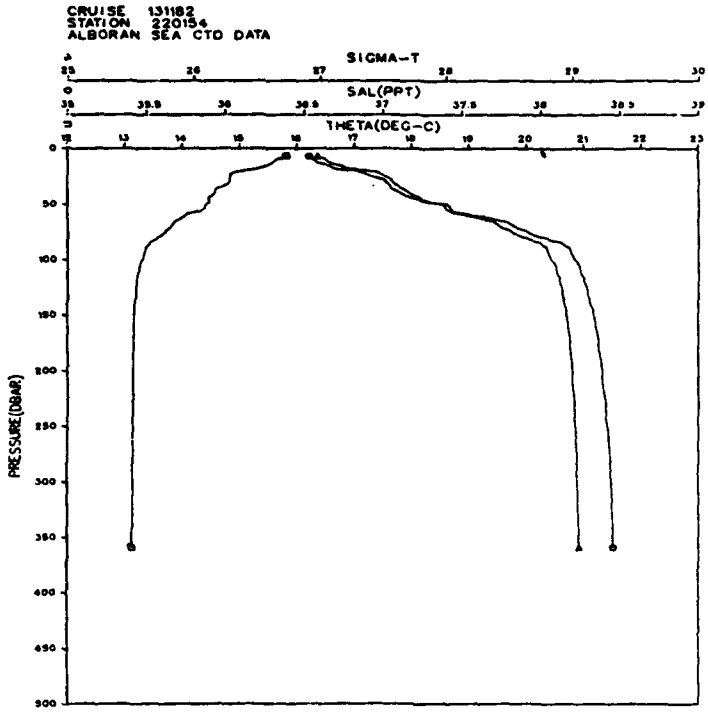


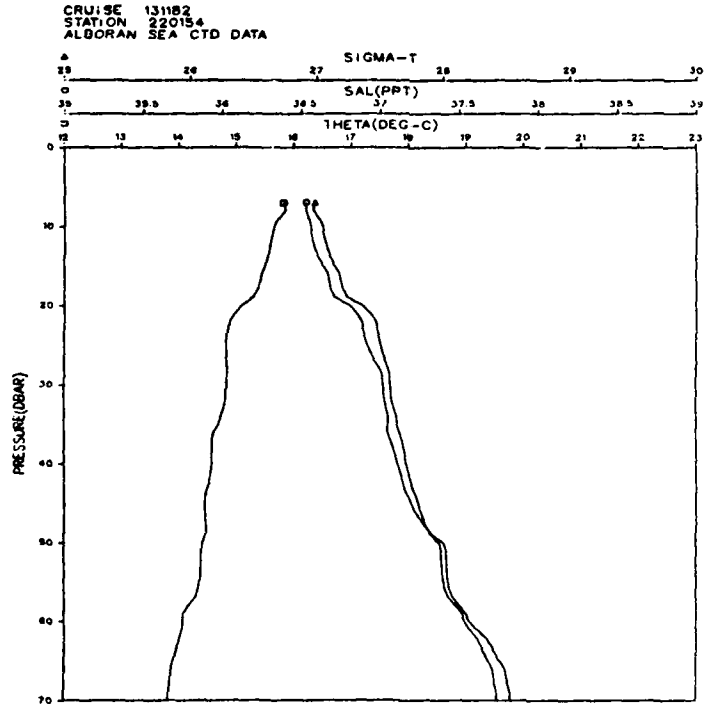


Figures 46c and 46d

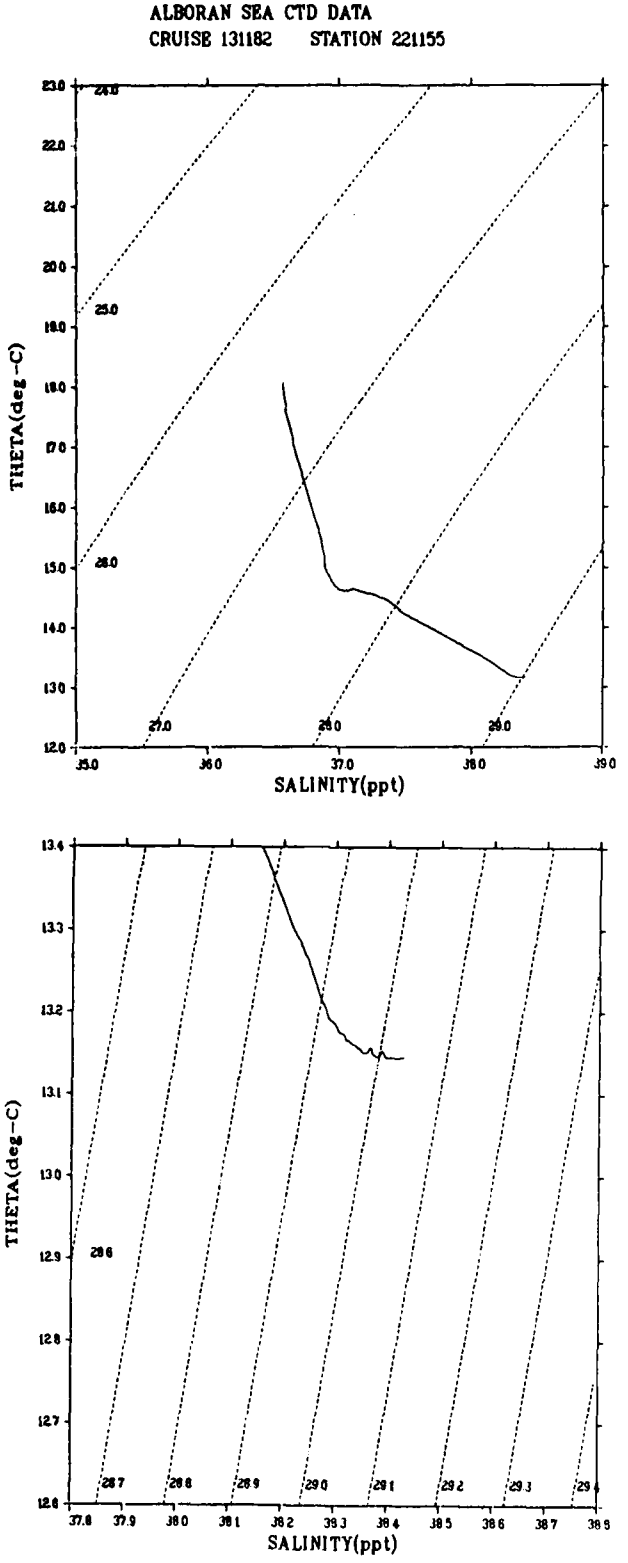


Figures 47a and 47b

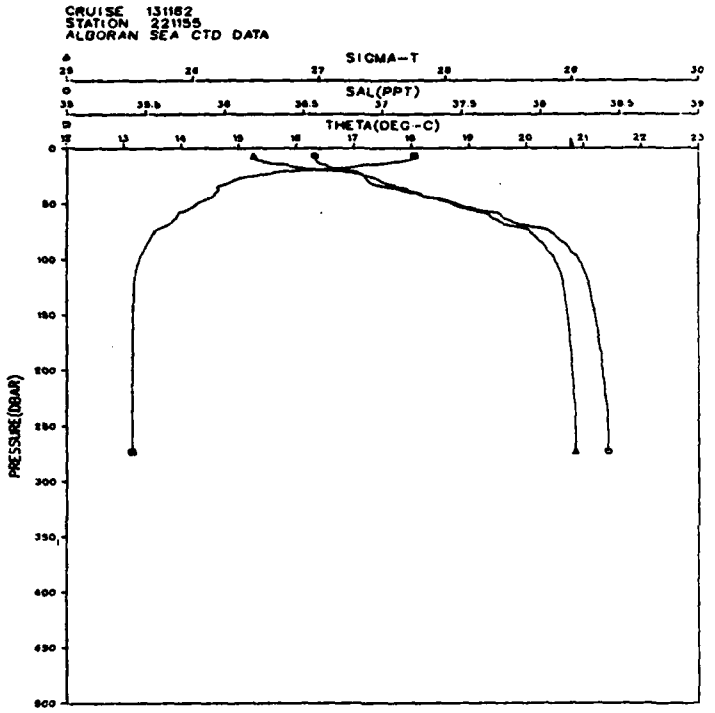


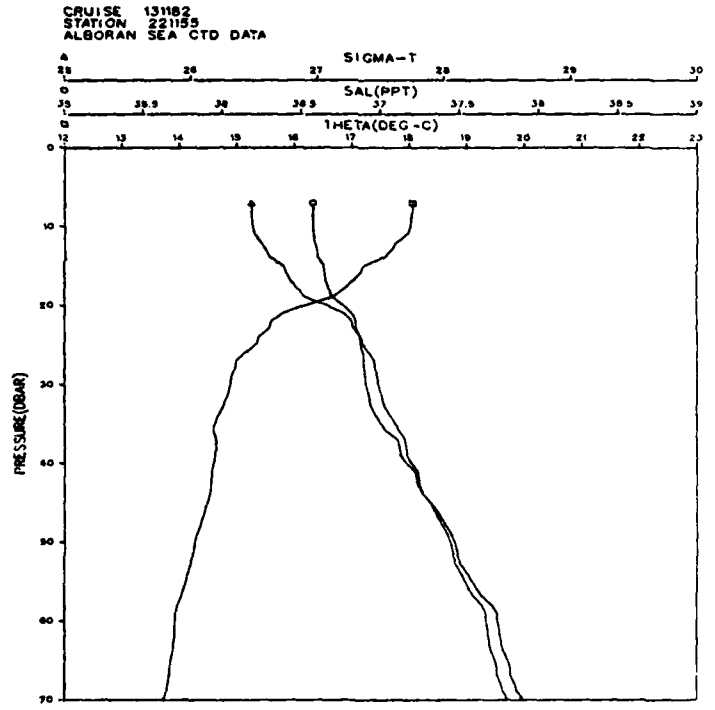


Figures 47c and 47d

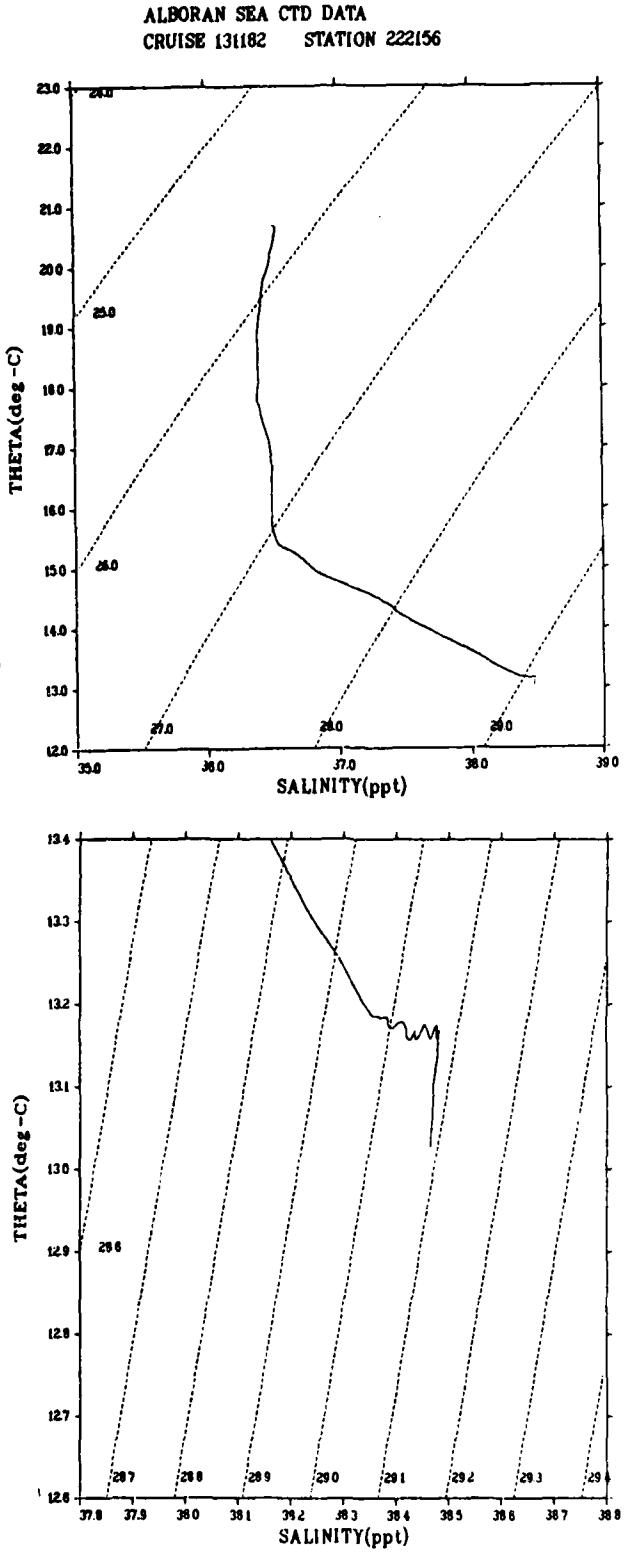


Figures 48a and 48b

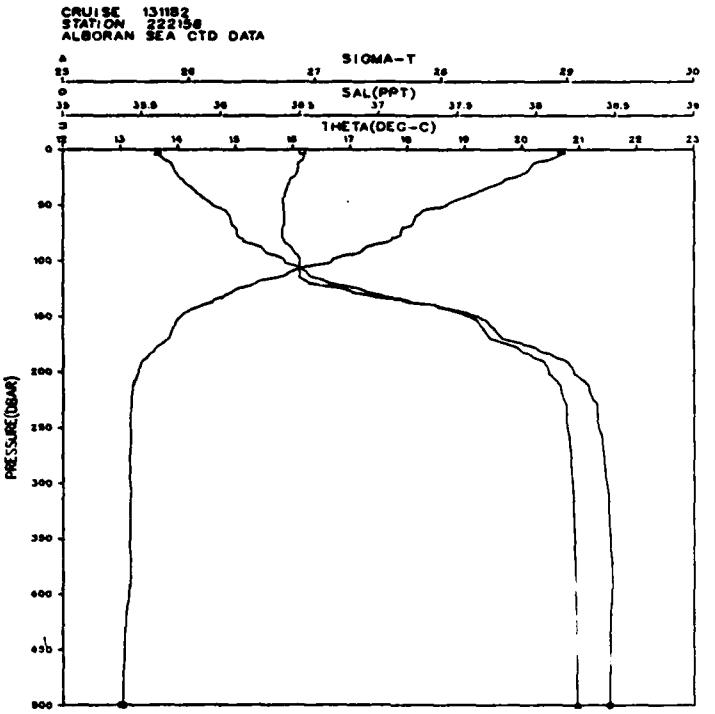


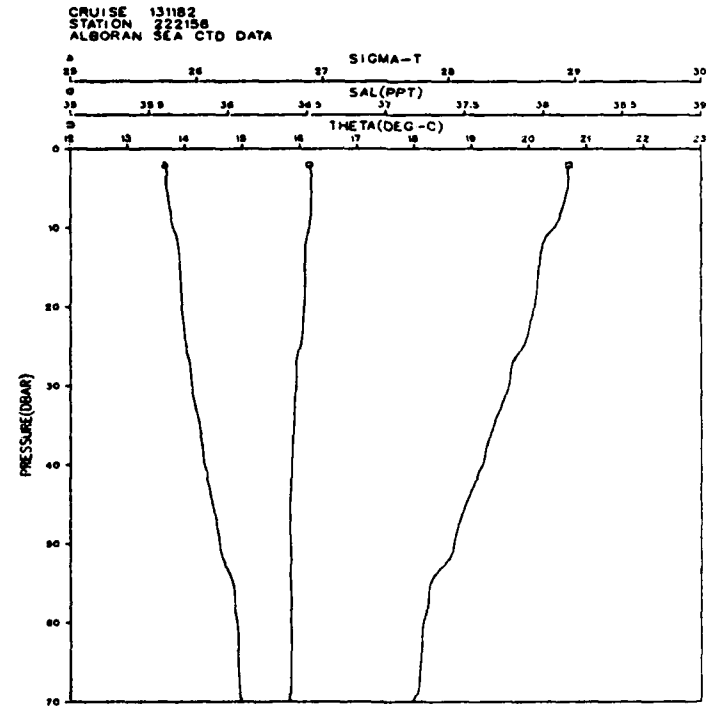


Figures 48c and 48d

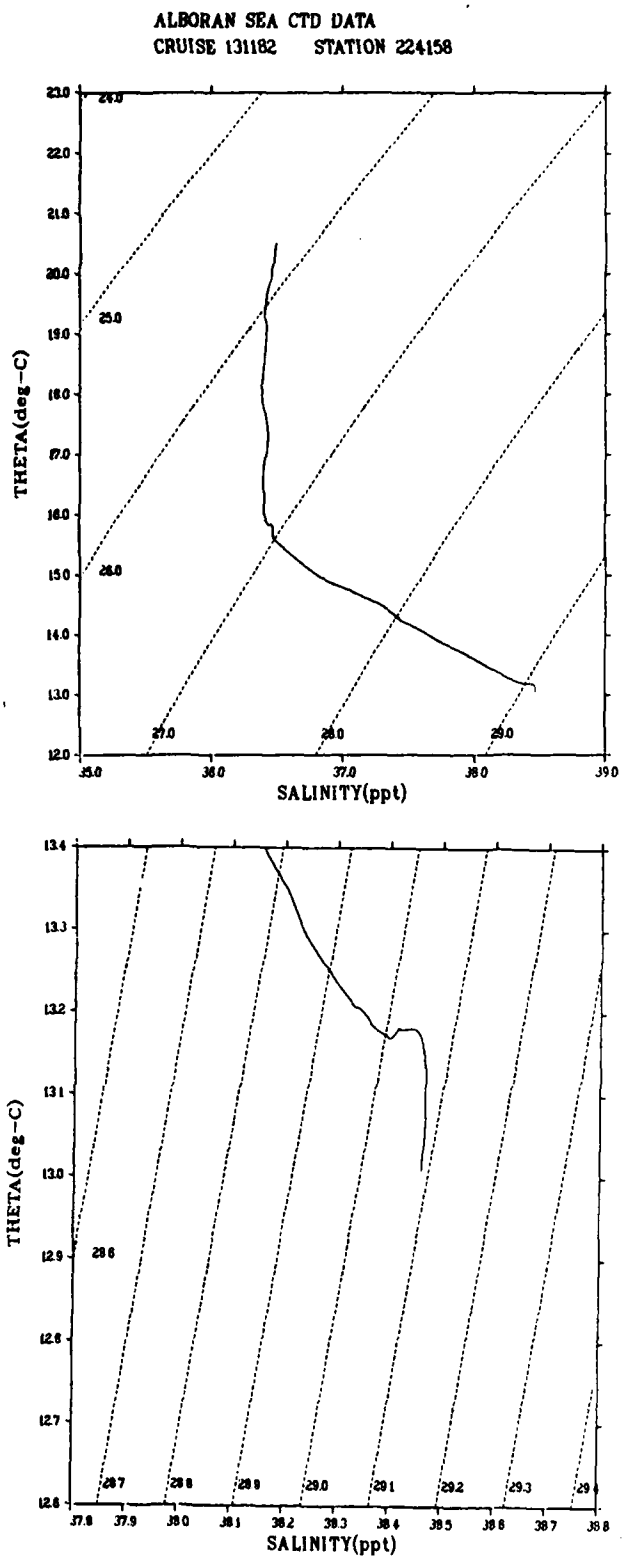


Figures 49a and 49b

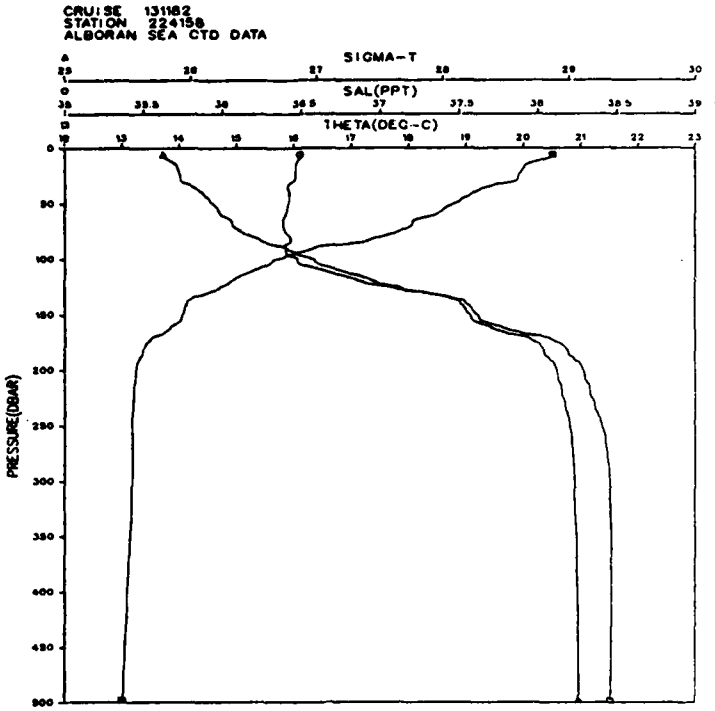


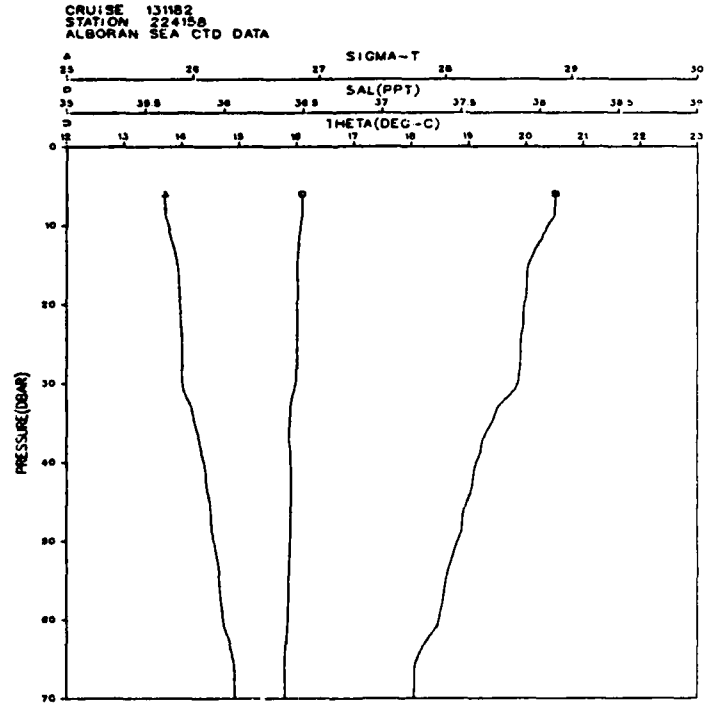


Figures 49c and 49d

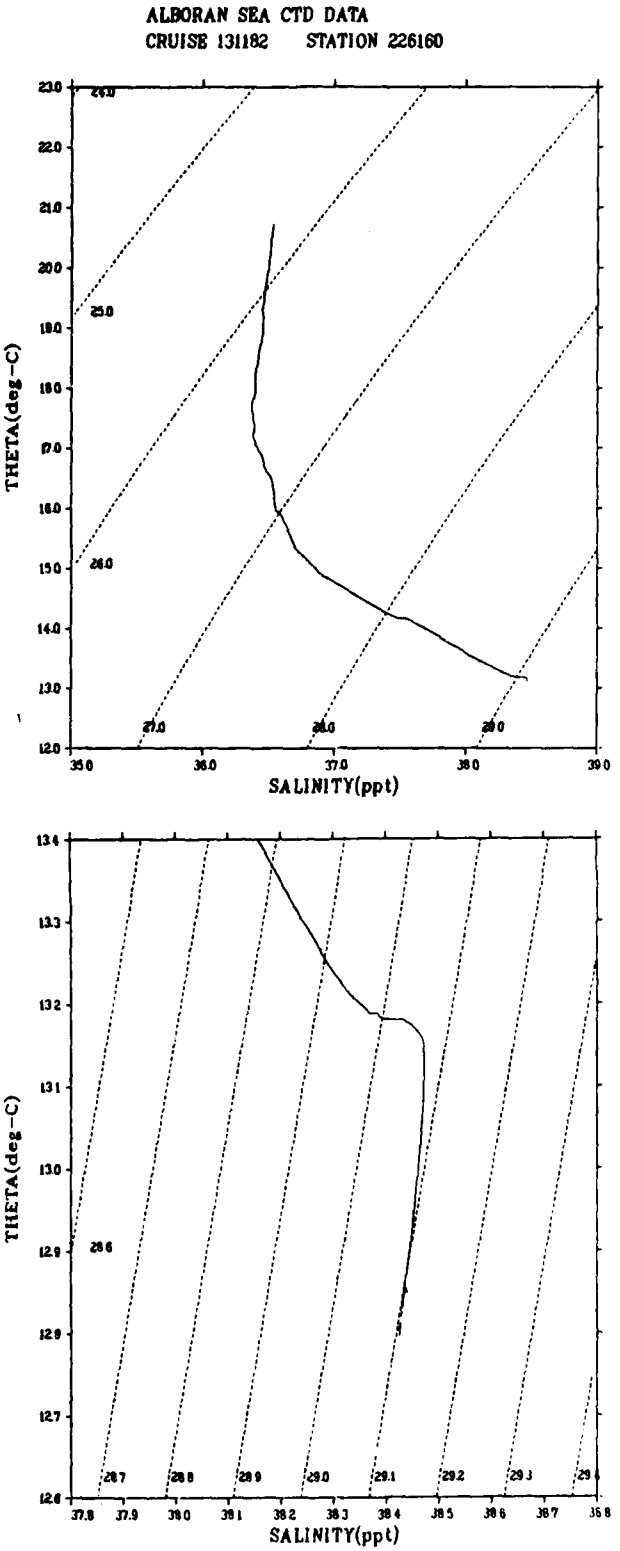


Figures 50a and 50b

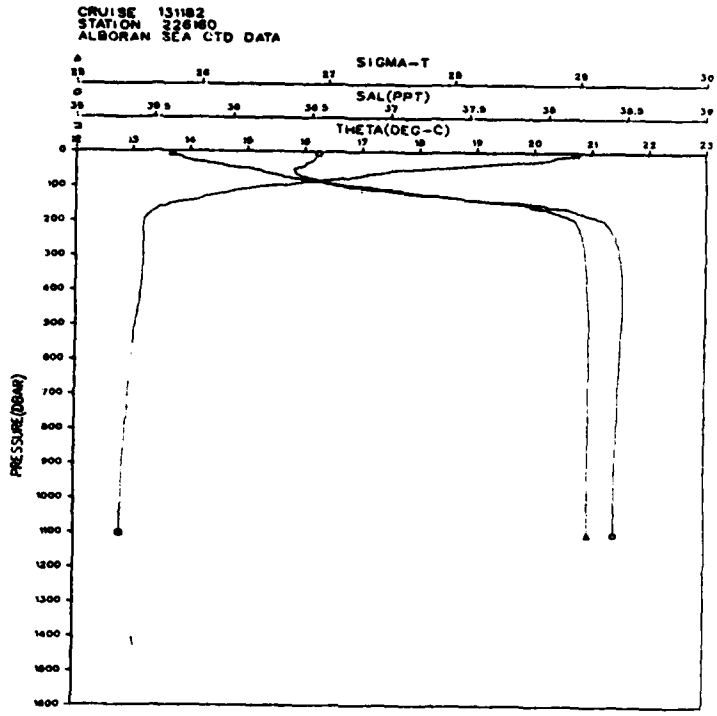


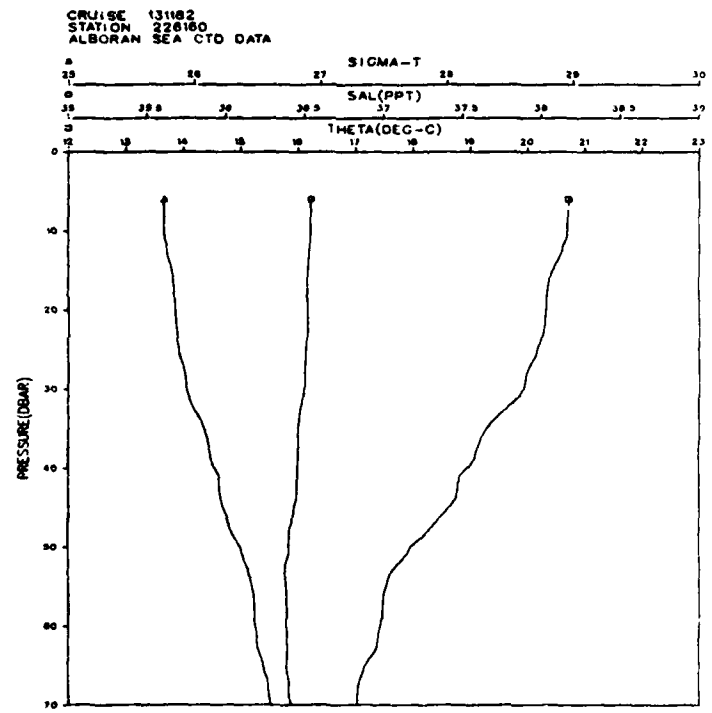


Figures 50c and 50d

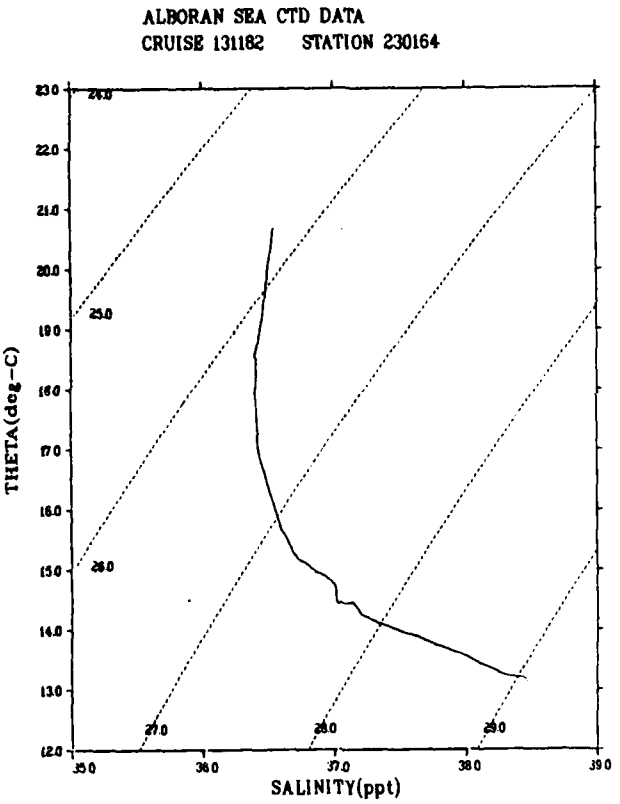


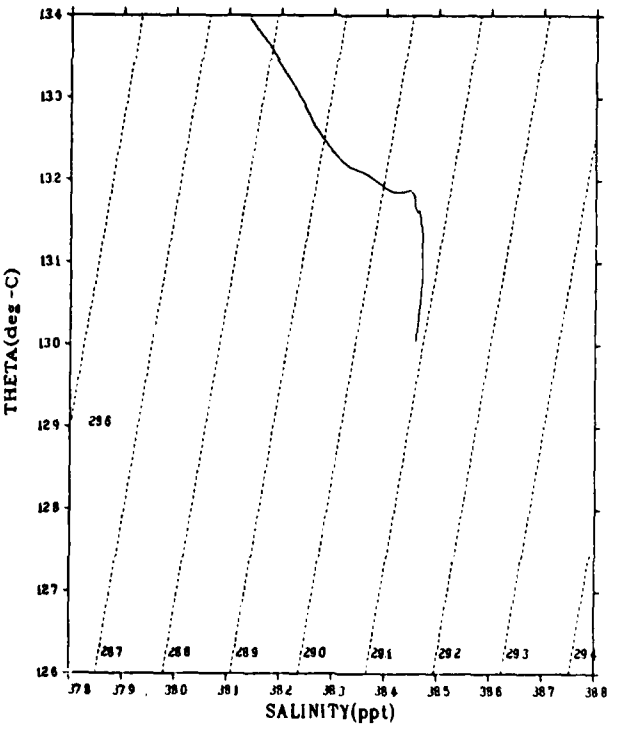
Figures 51a and 51b



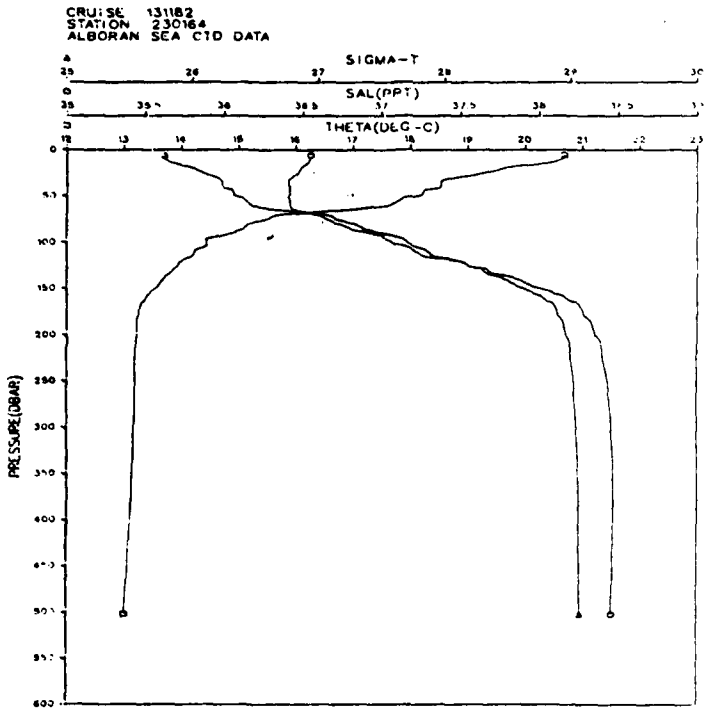


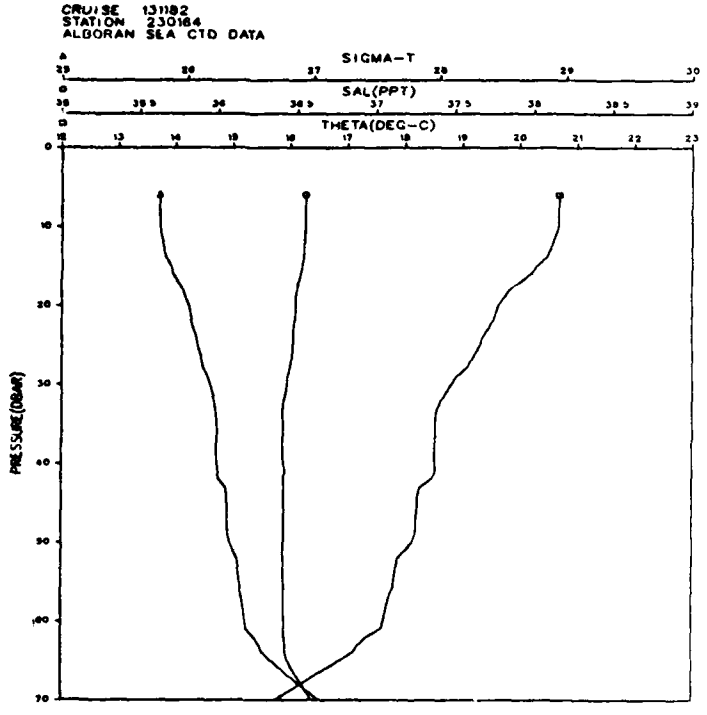
Figures 51c and 51d



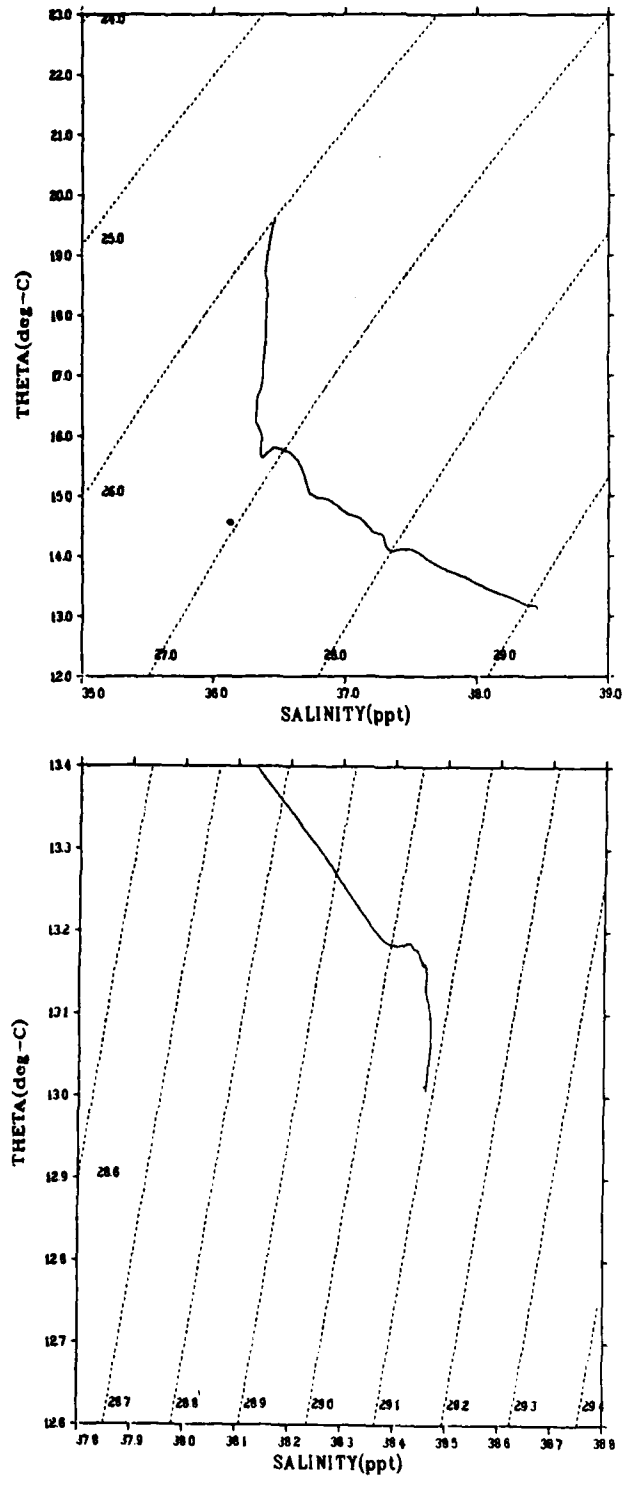


Figures 52a and 52b

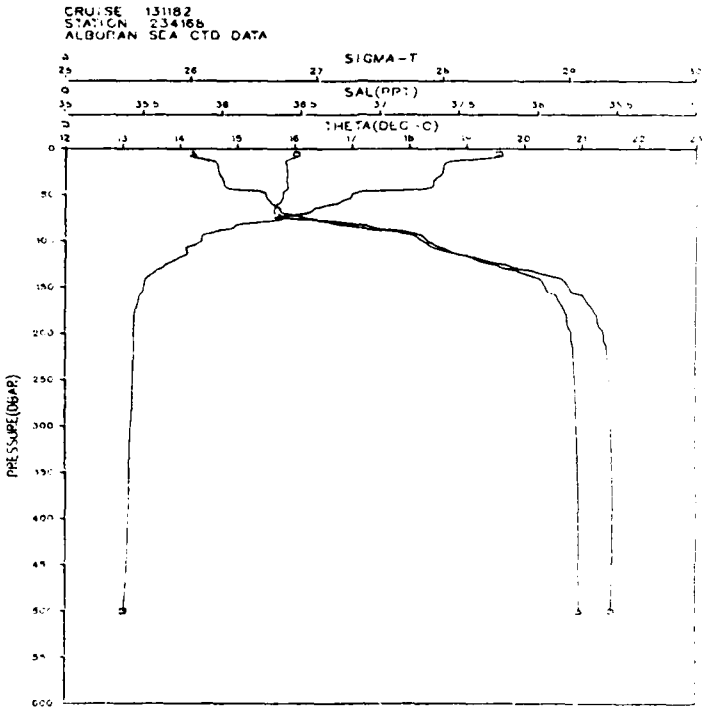


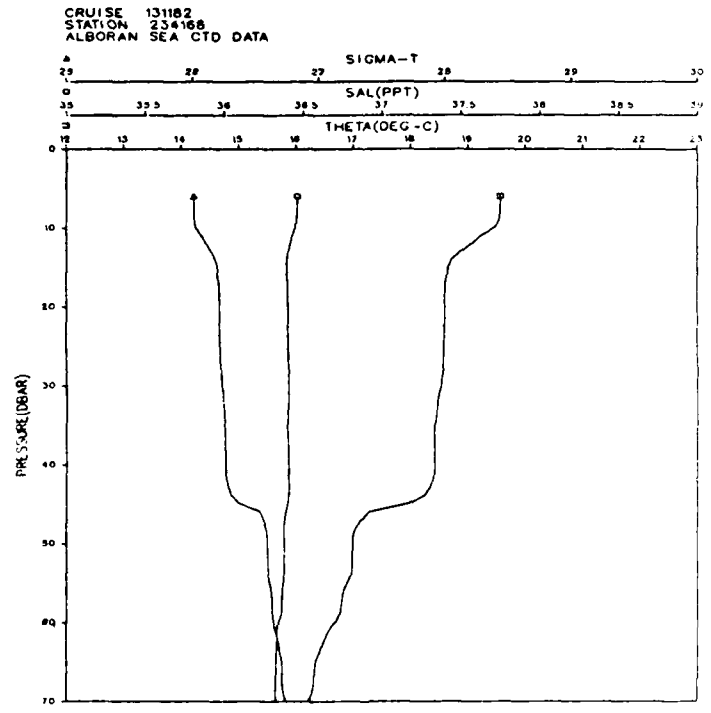


Figures 52c and 52d

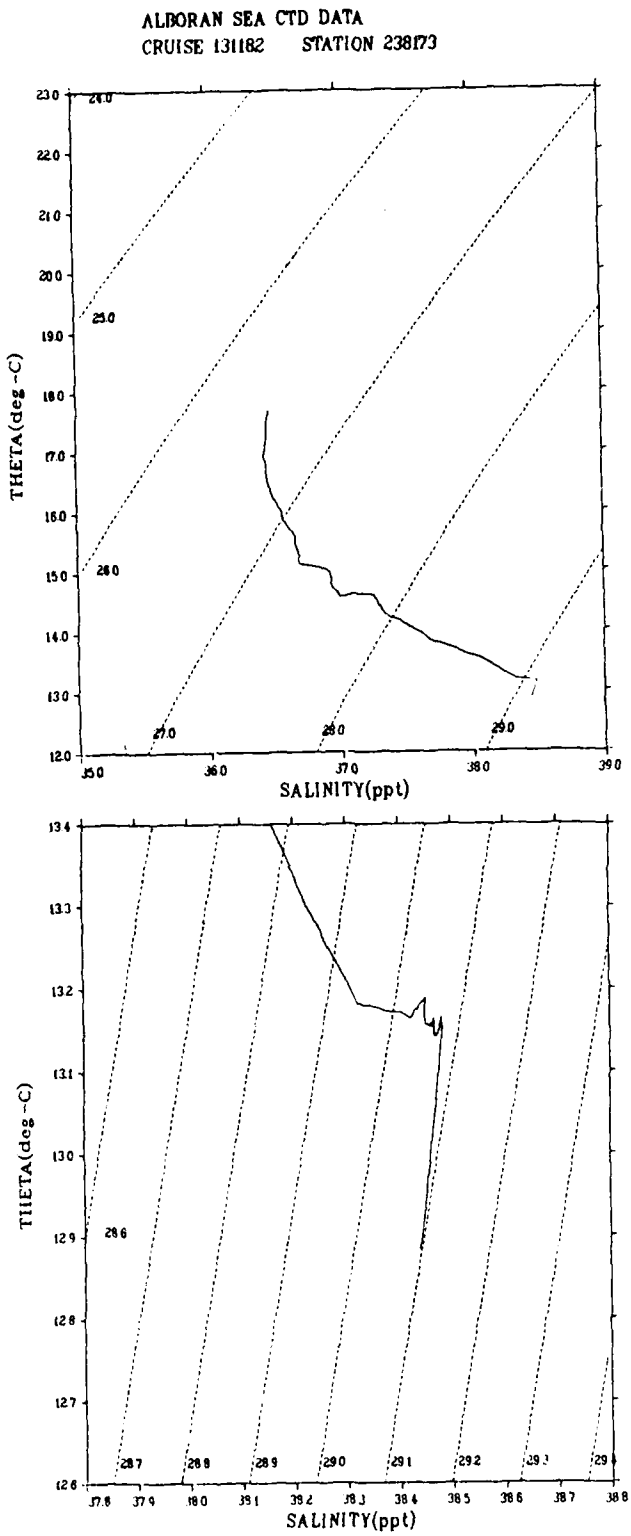


Figures 53a and 53b

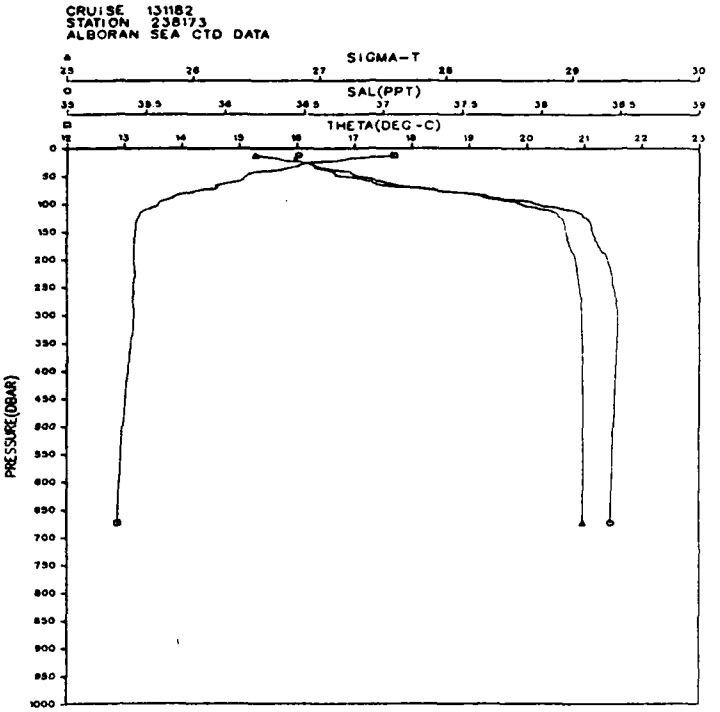


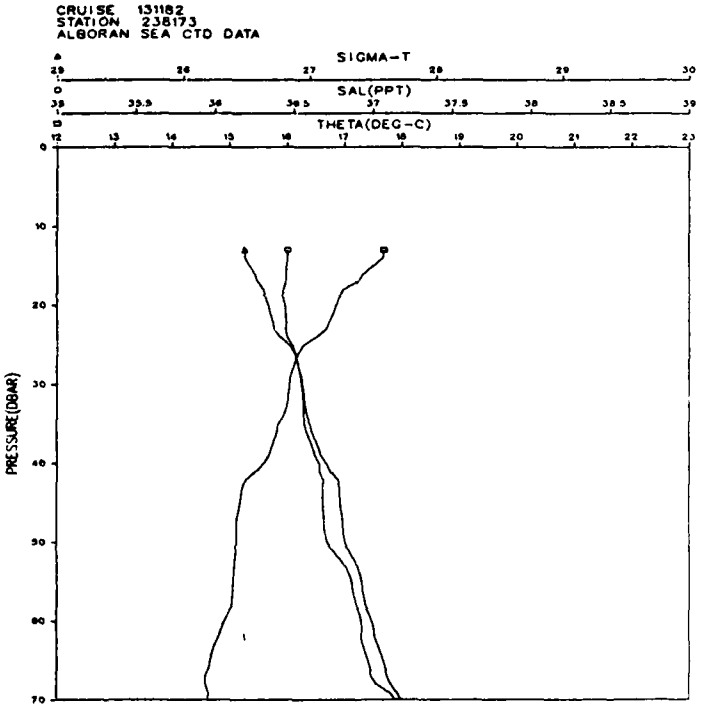


Figures 53c and 53d

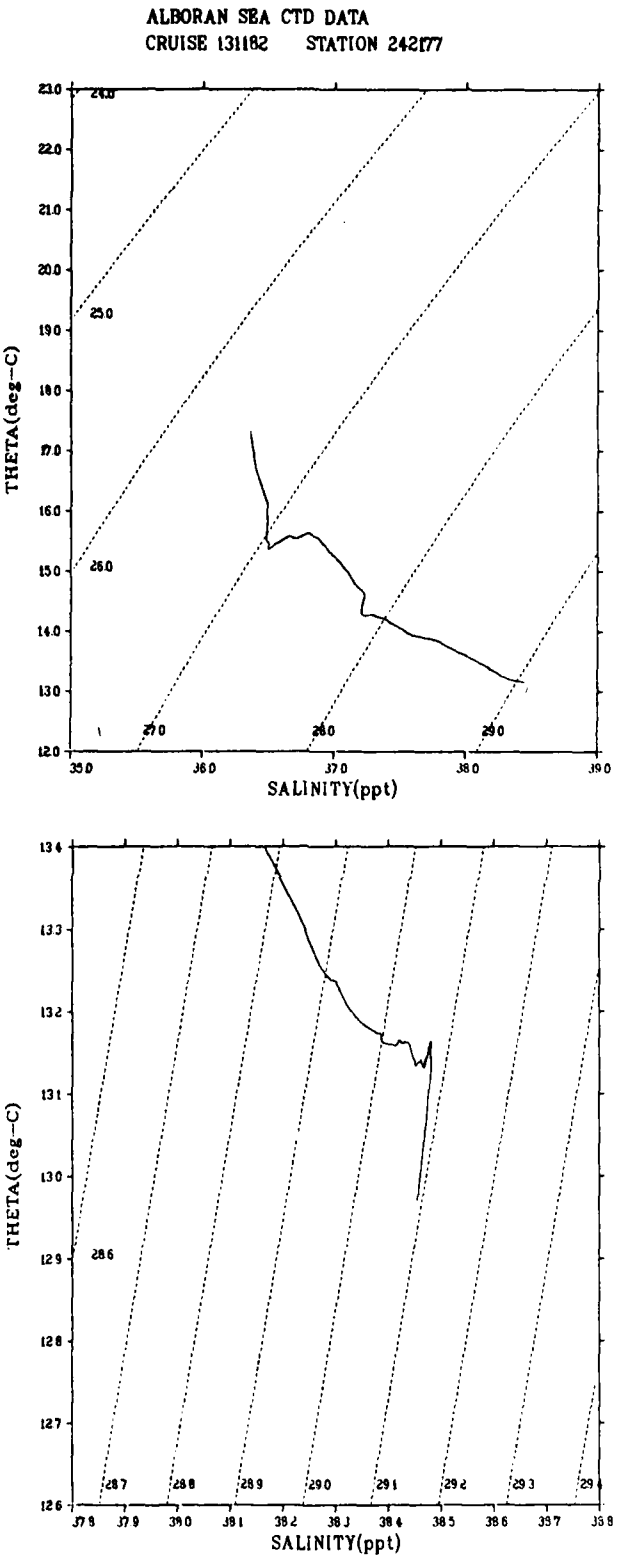


Figures 54a and 54b

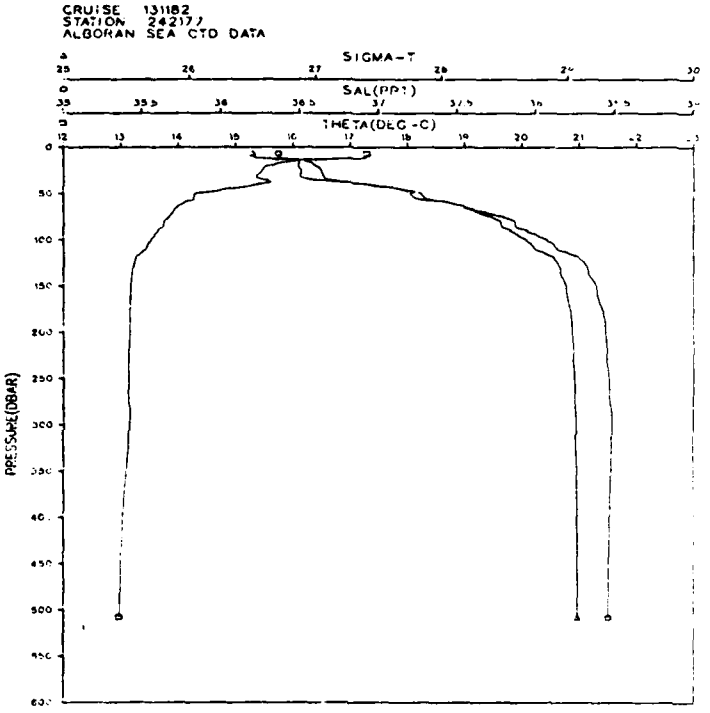


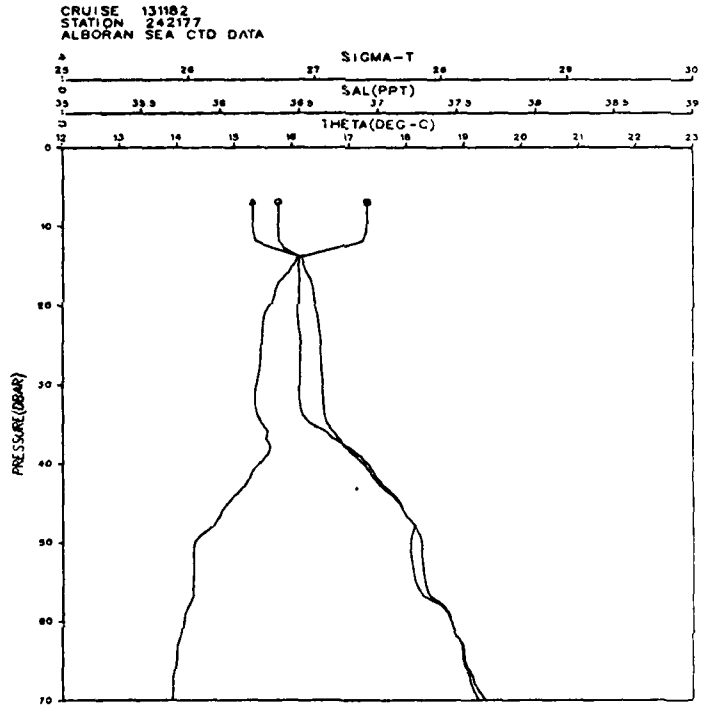


Figures 54c and 54d

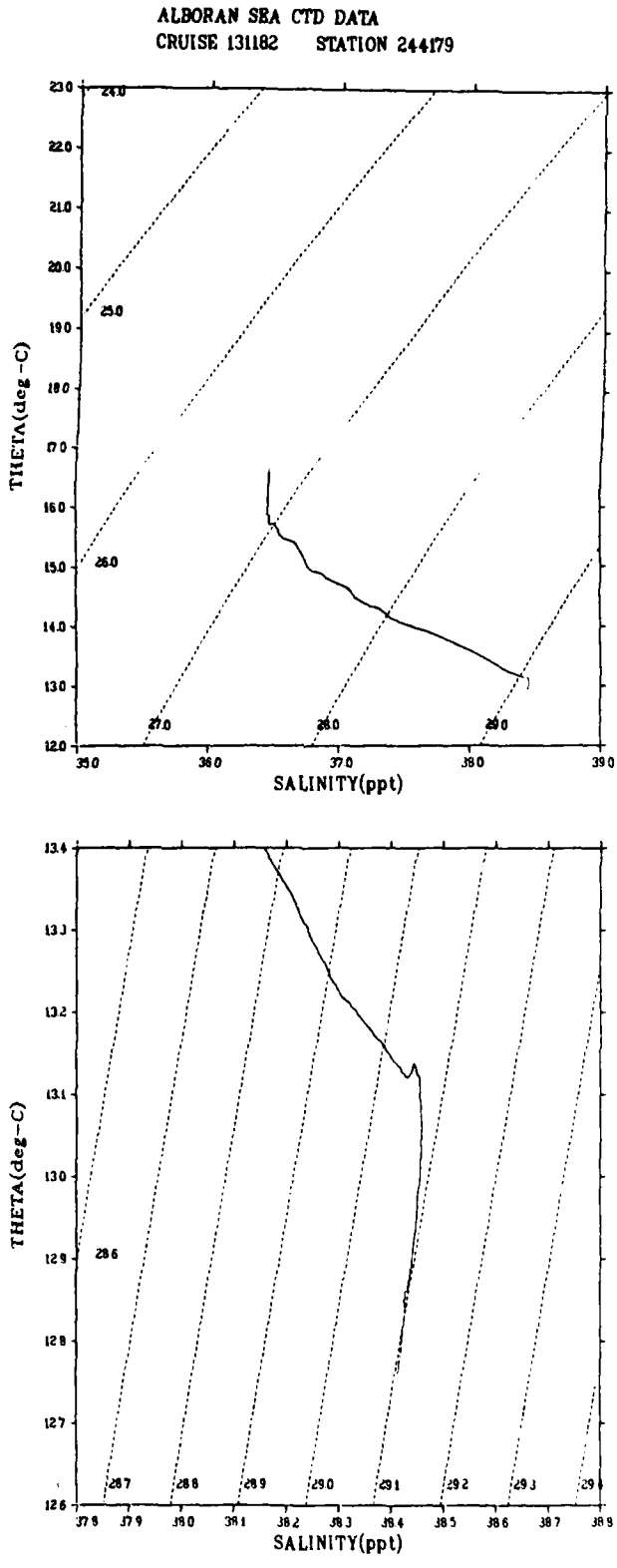


Figures 55a and 55b

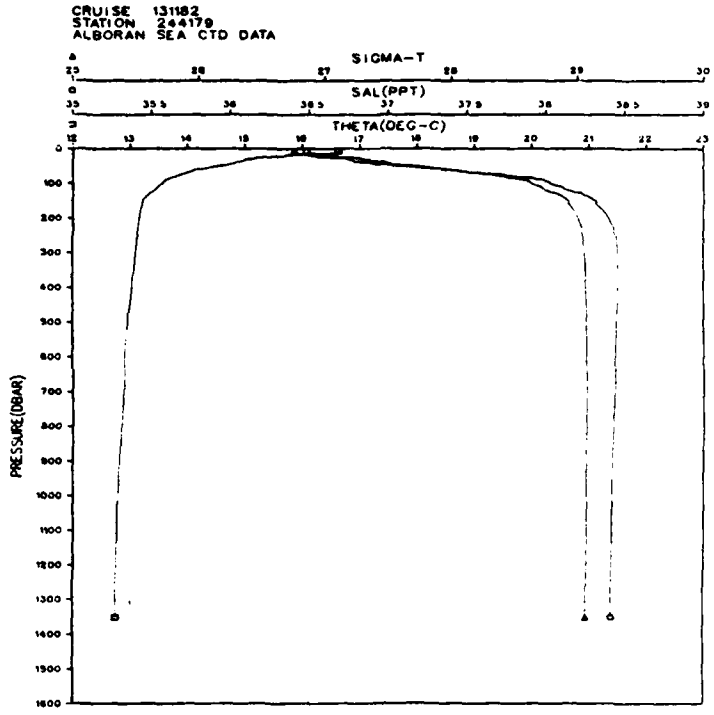


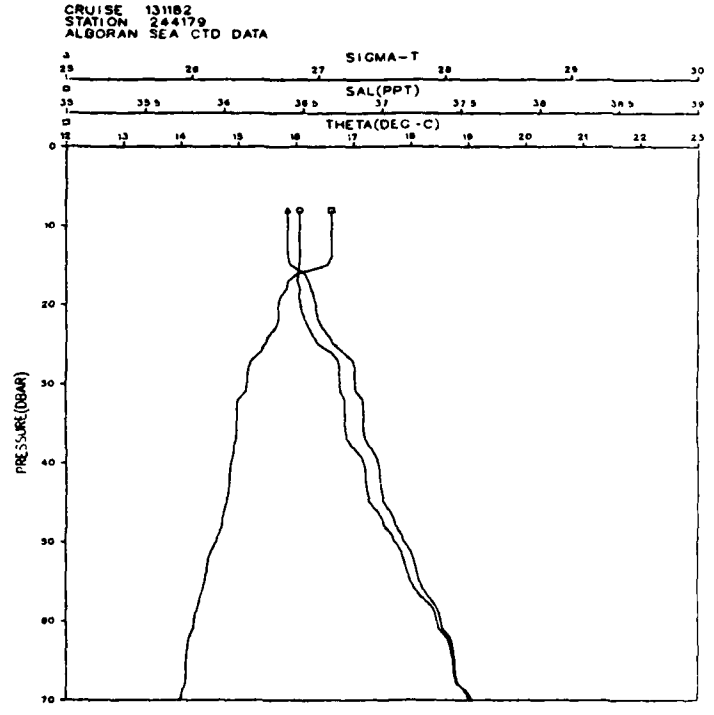


Figures 55c and 55d

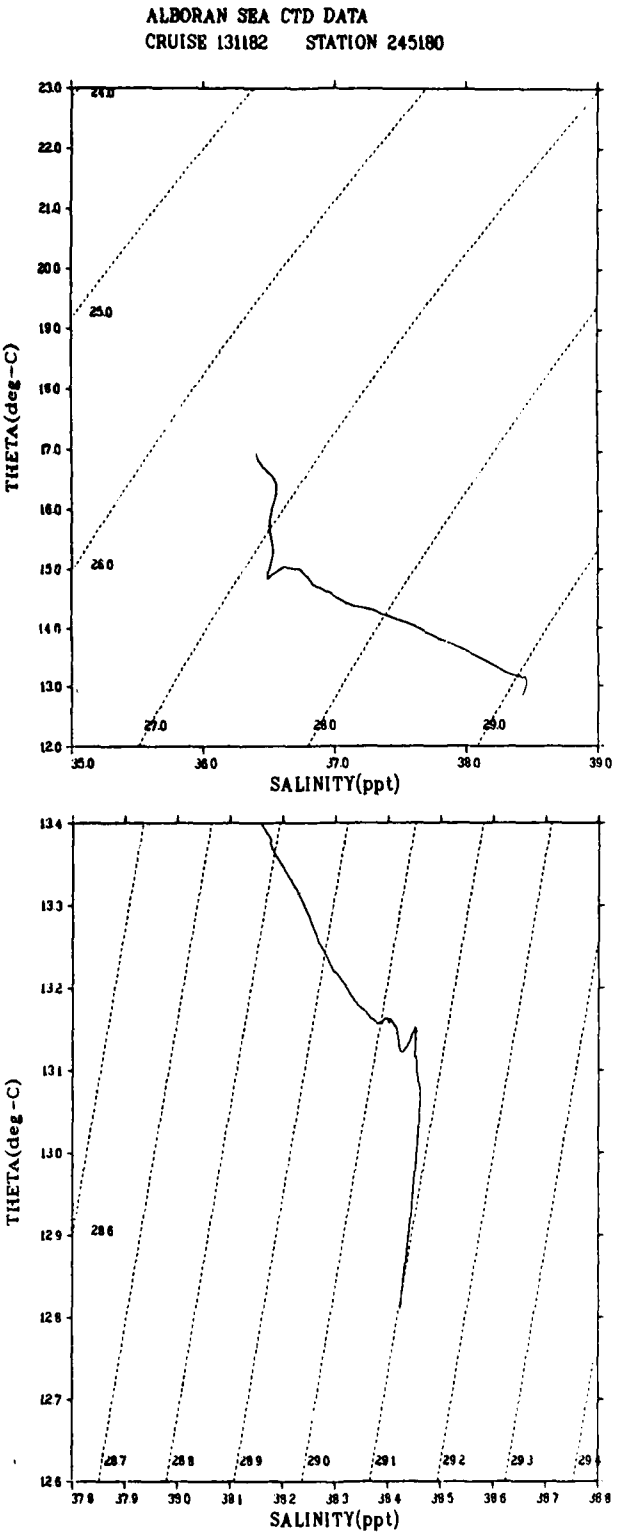


Figures 56a and 56b

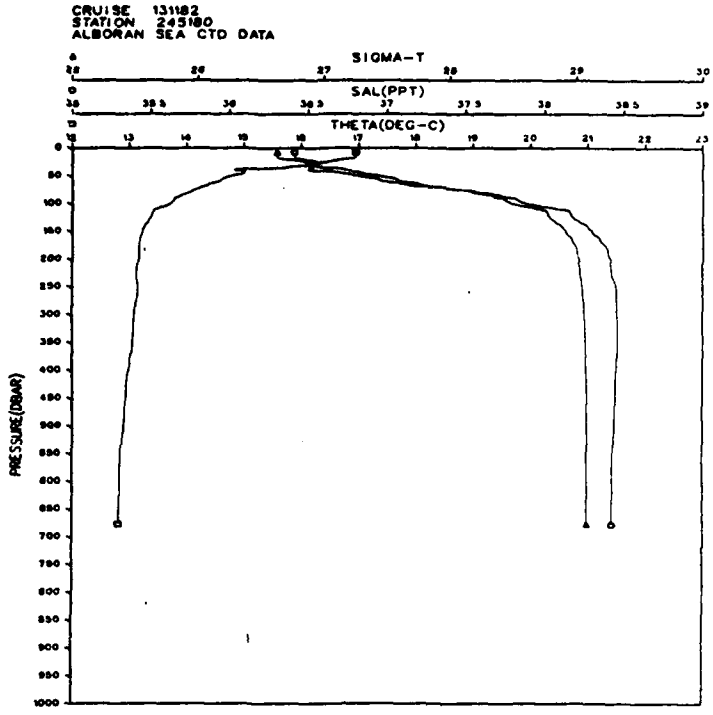


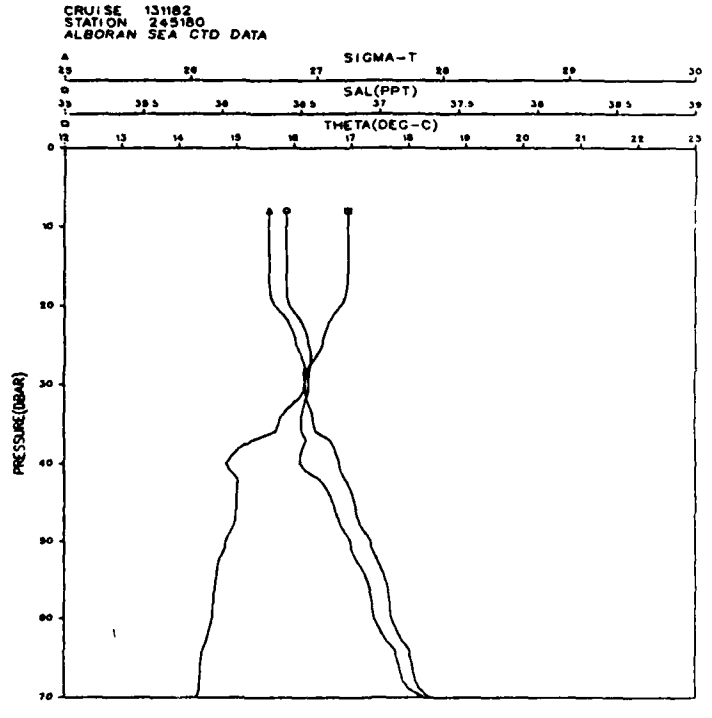


Figures 56c and 56d



Figures 57a and 57b





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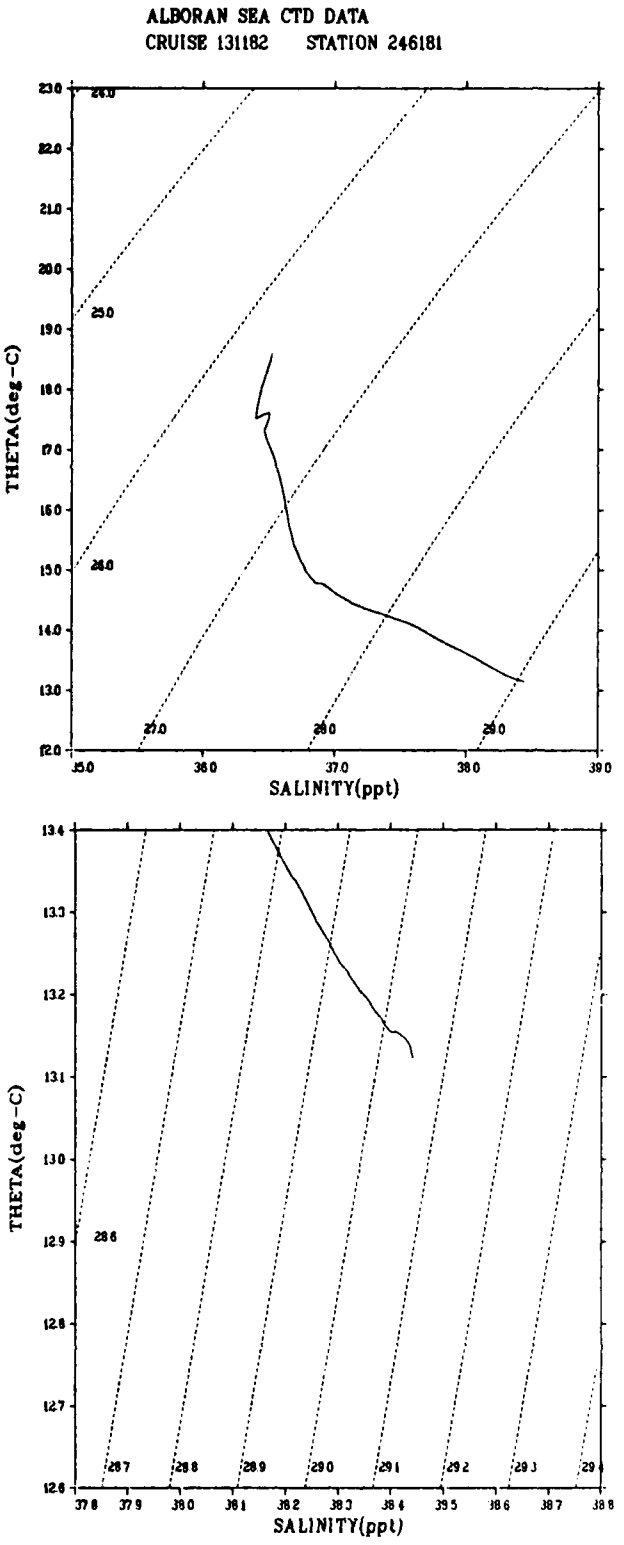

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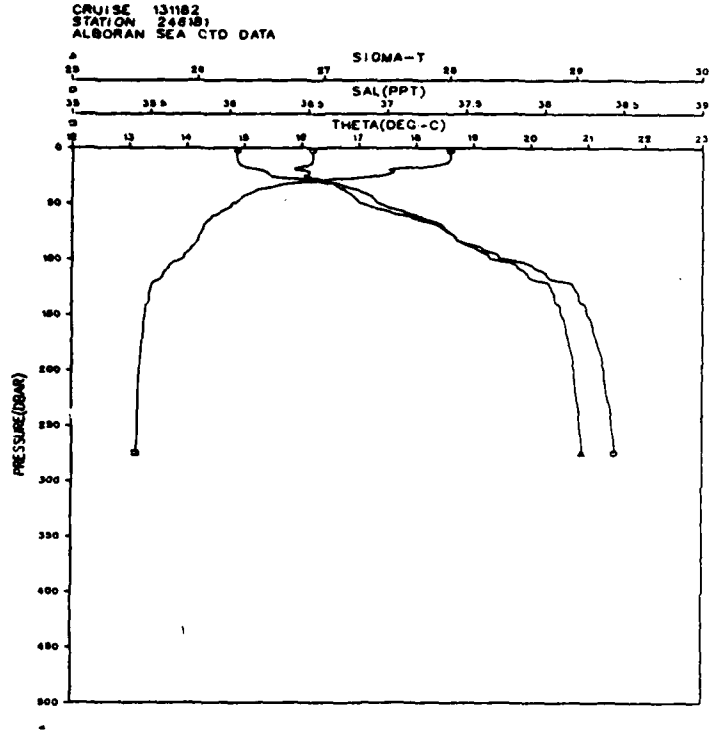

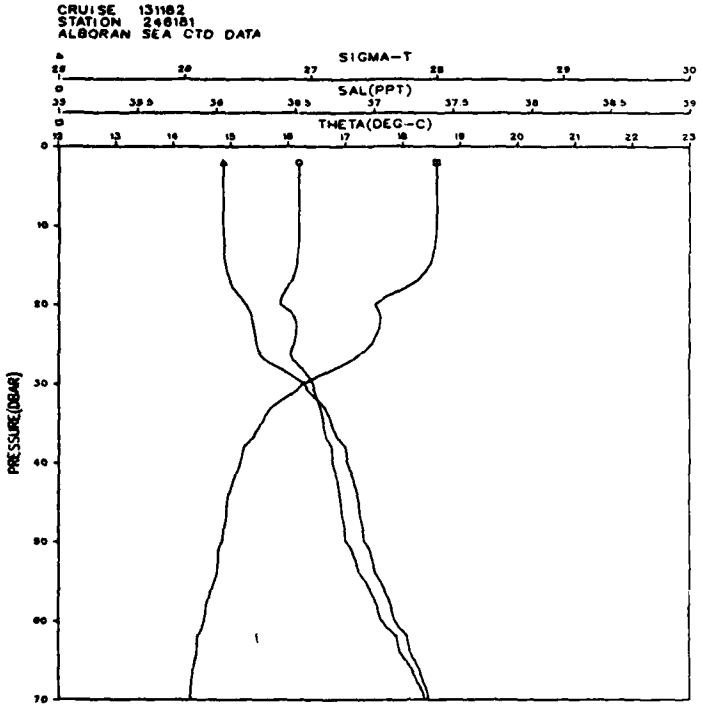

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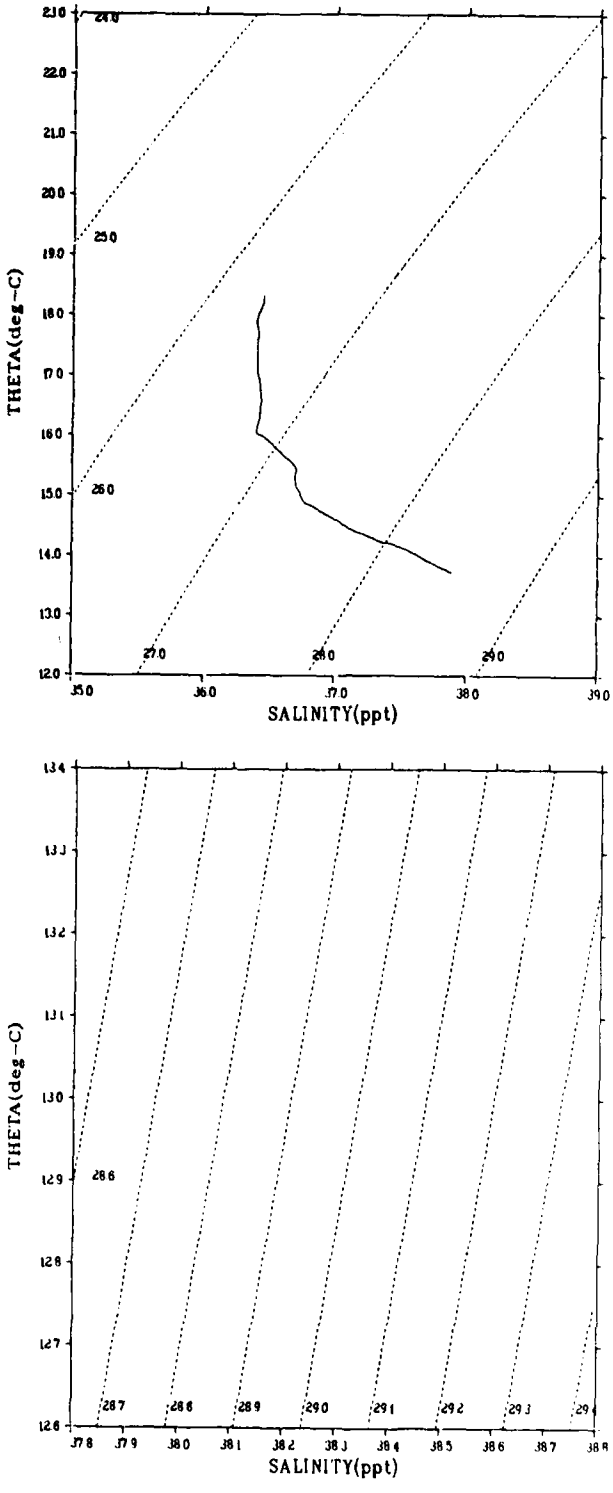

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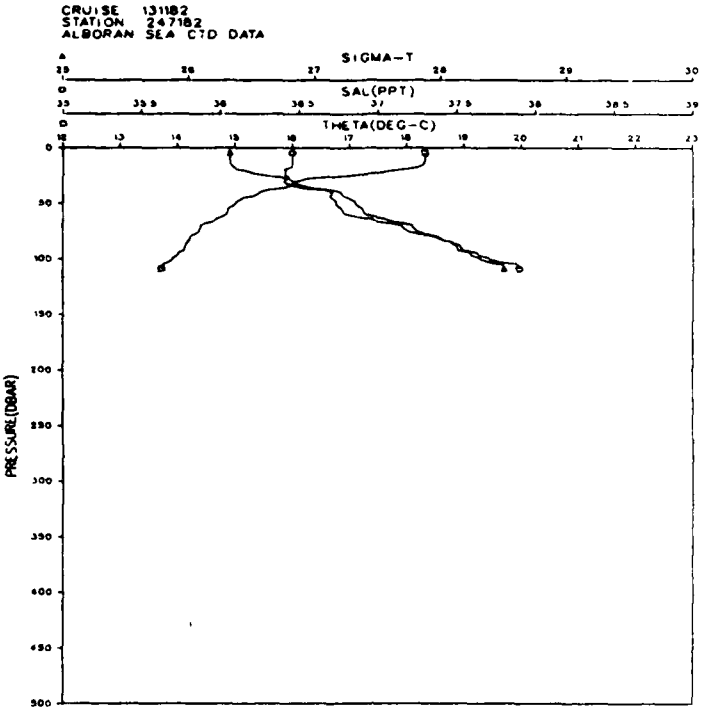

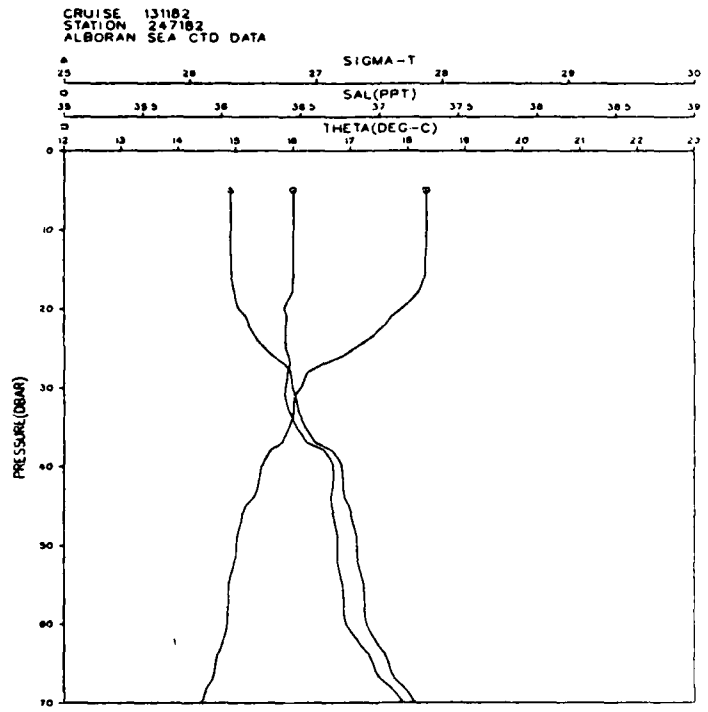

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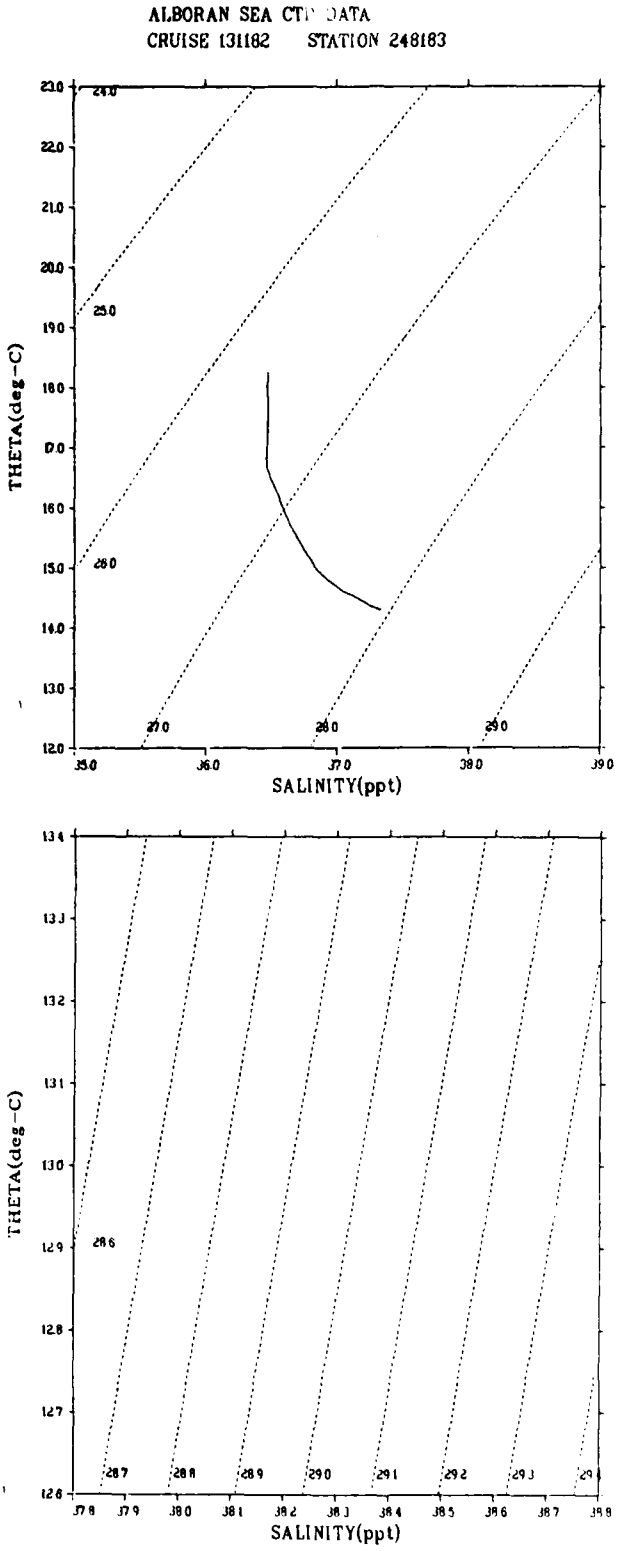

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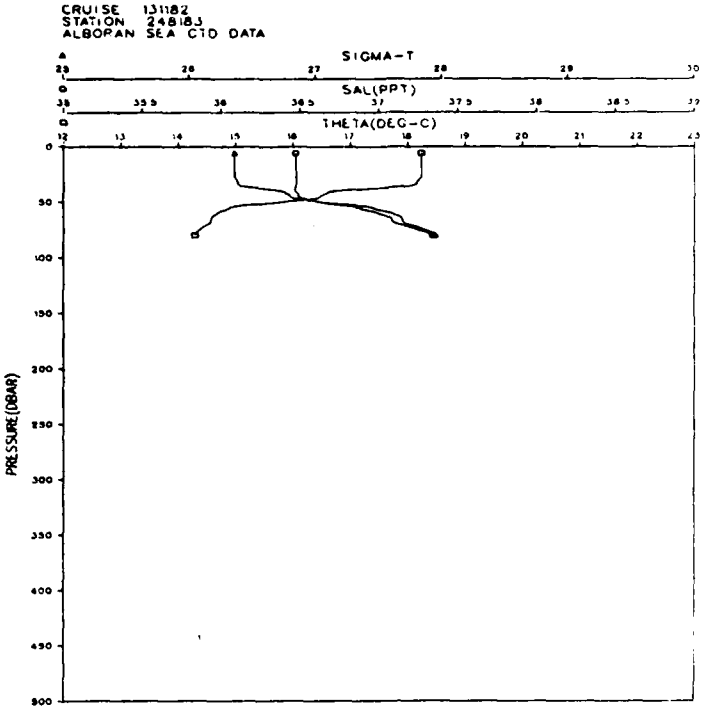

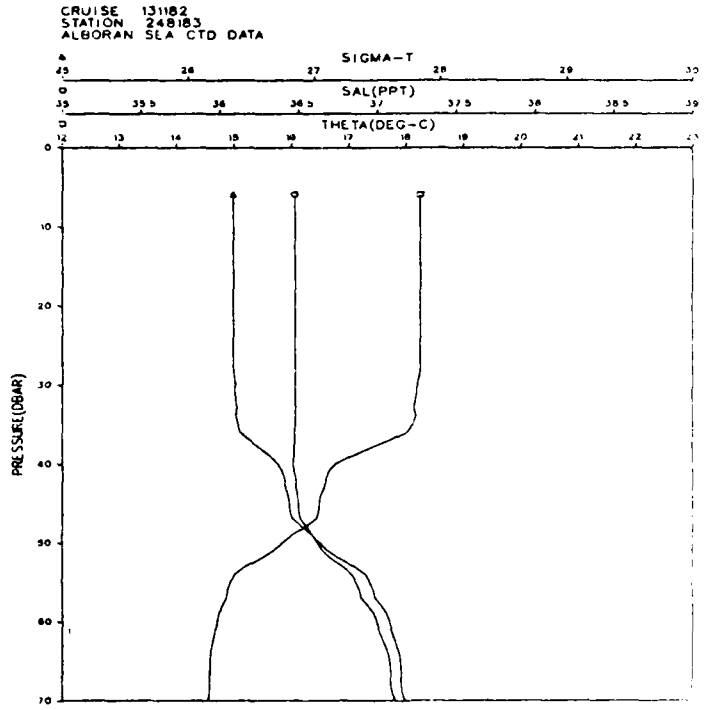

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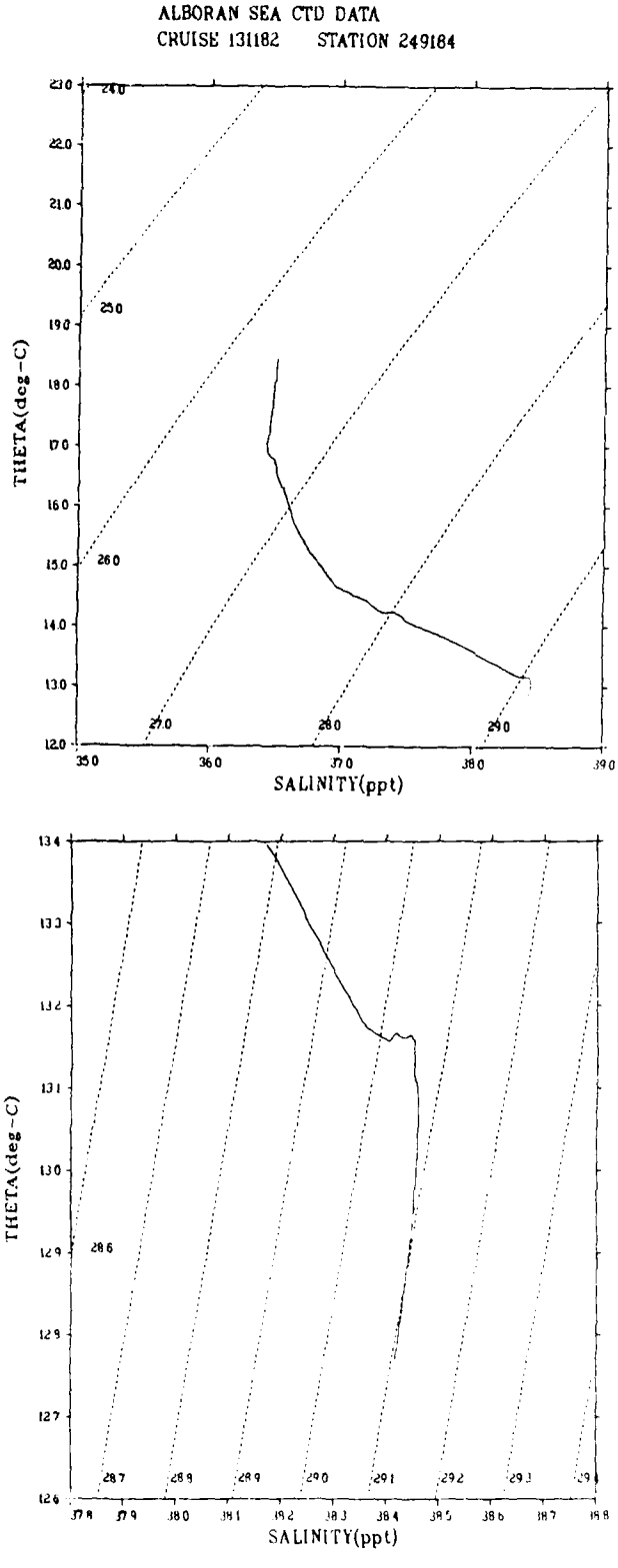

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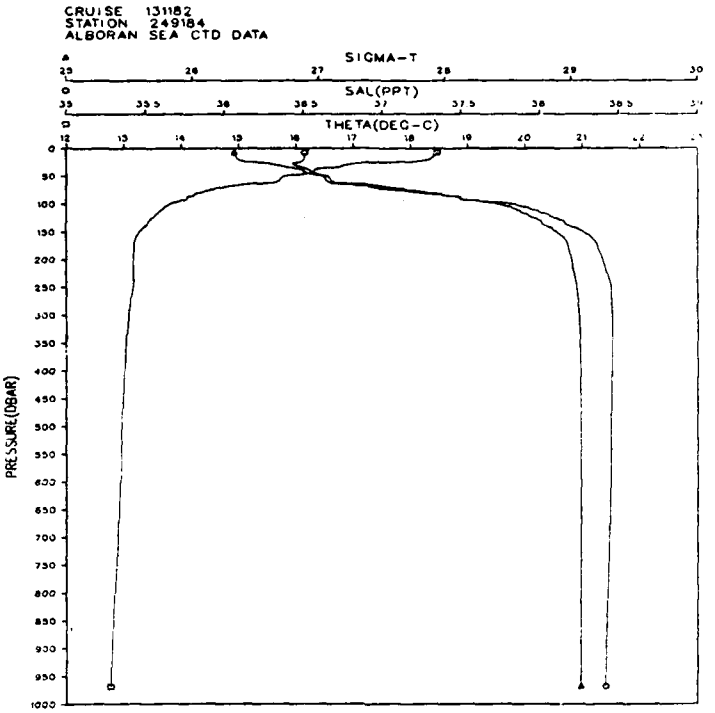

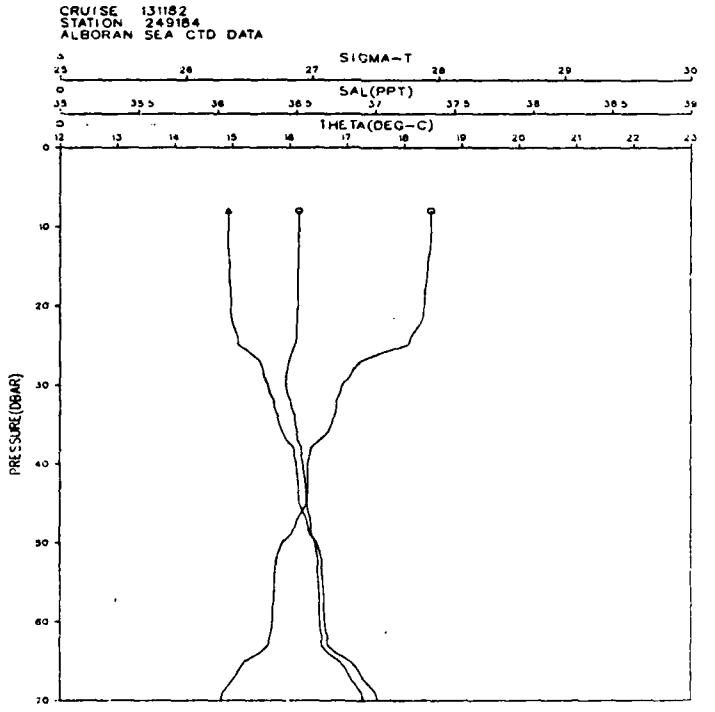

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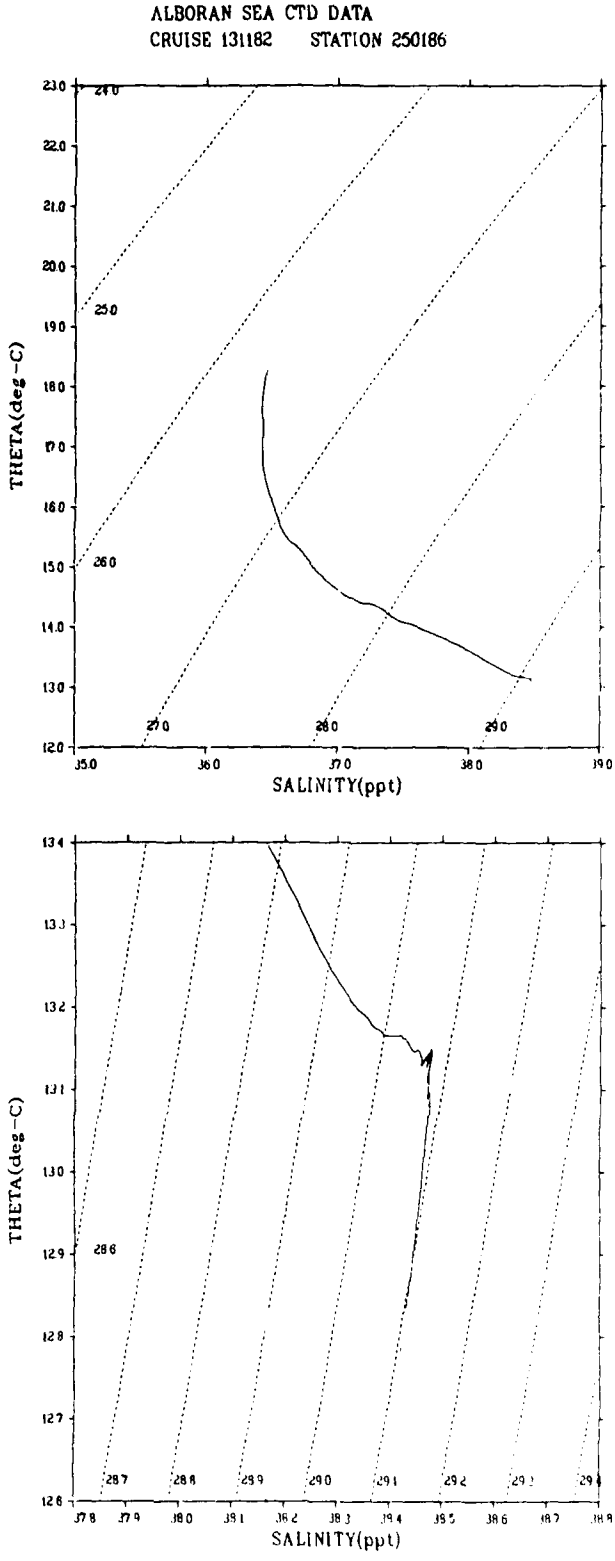

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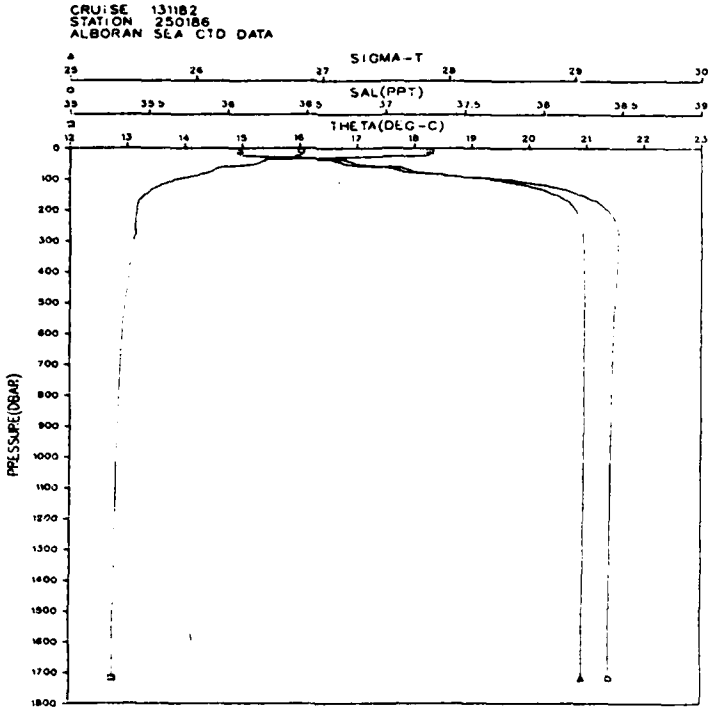

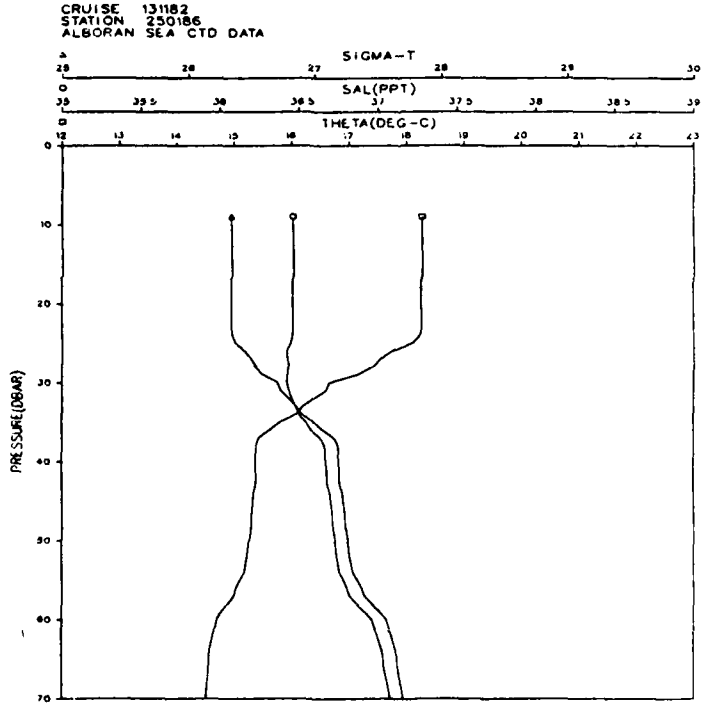

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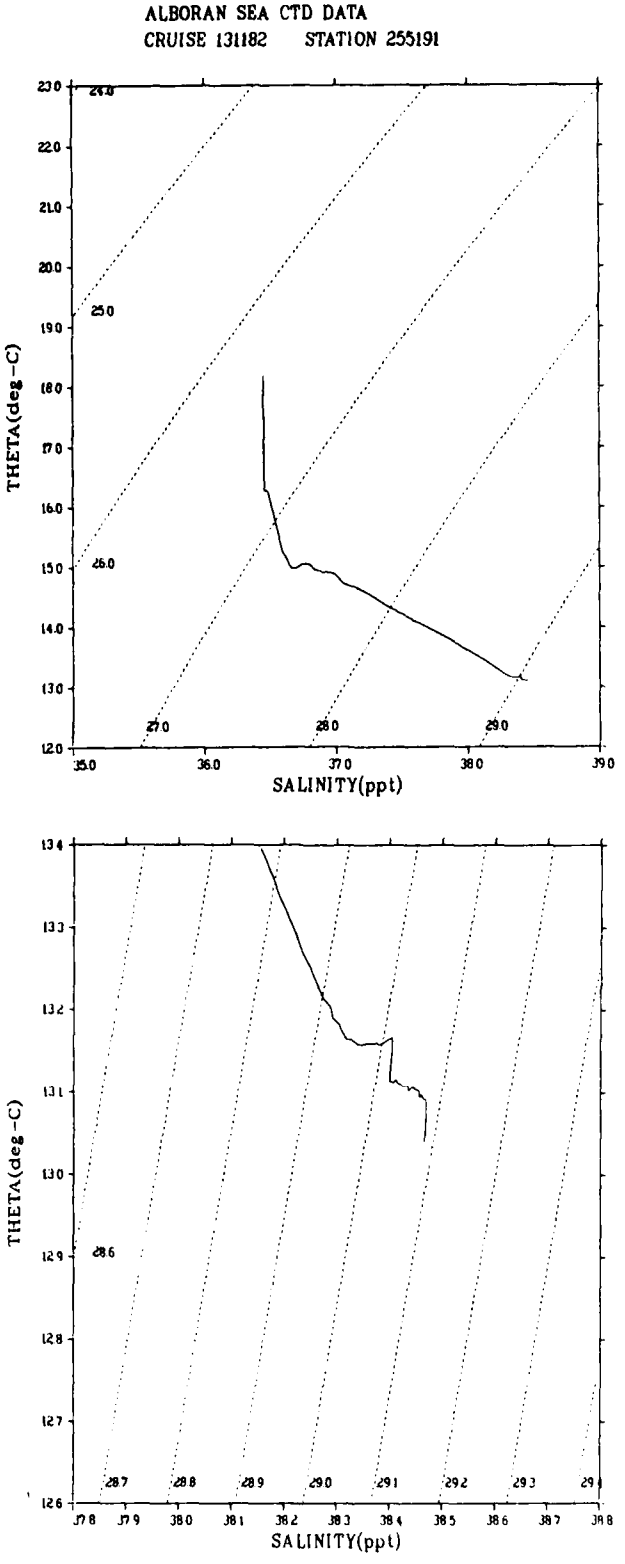

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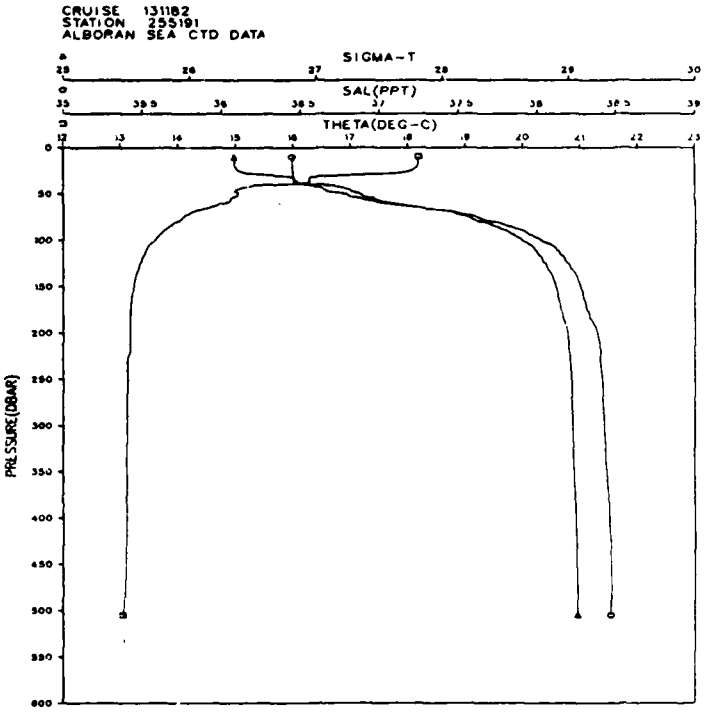

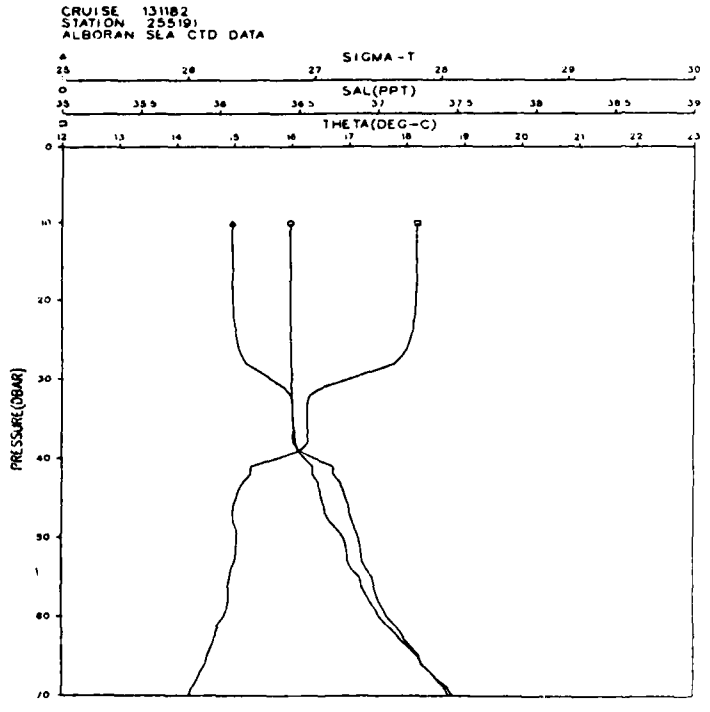

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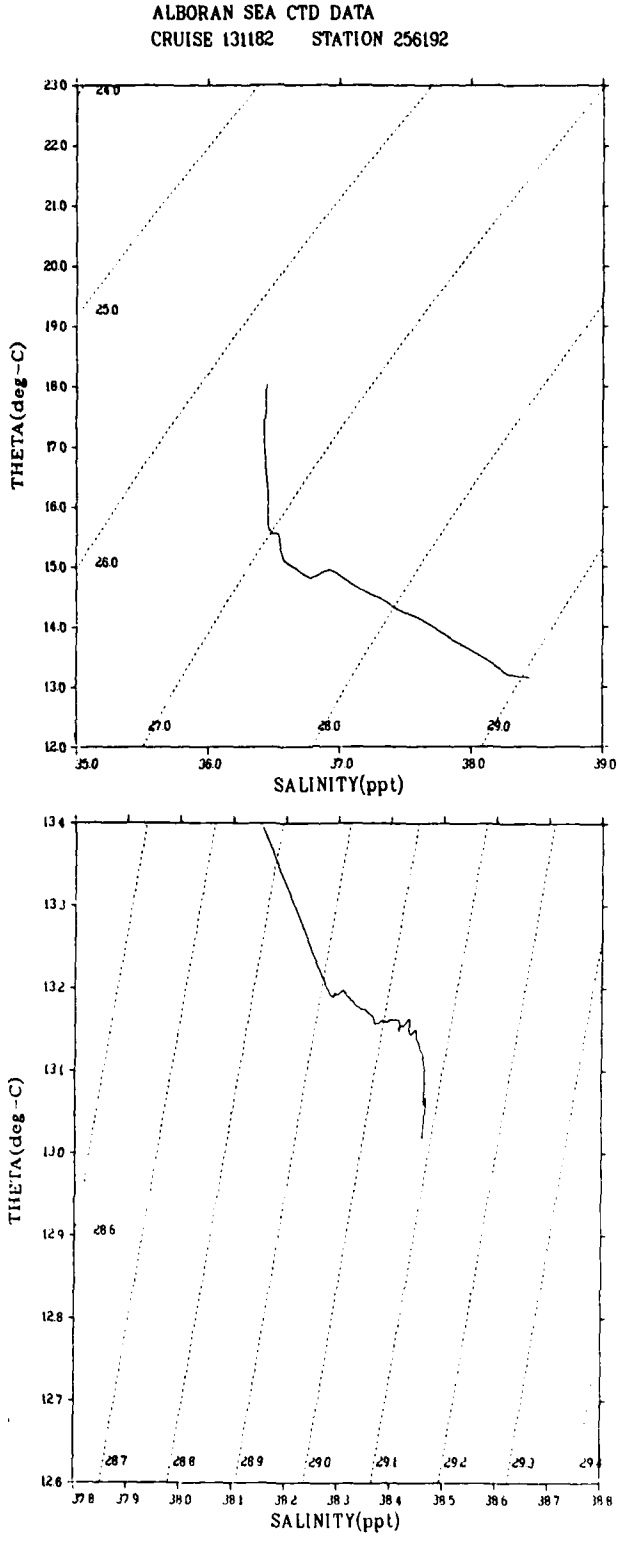

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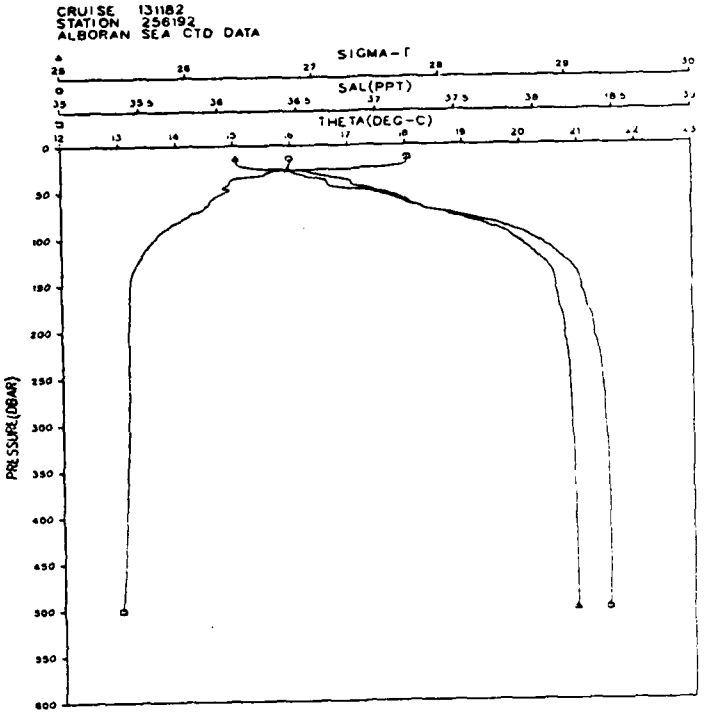

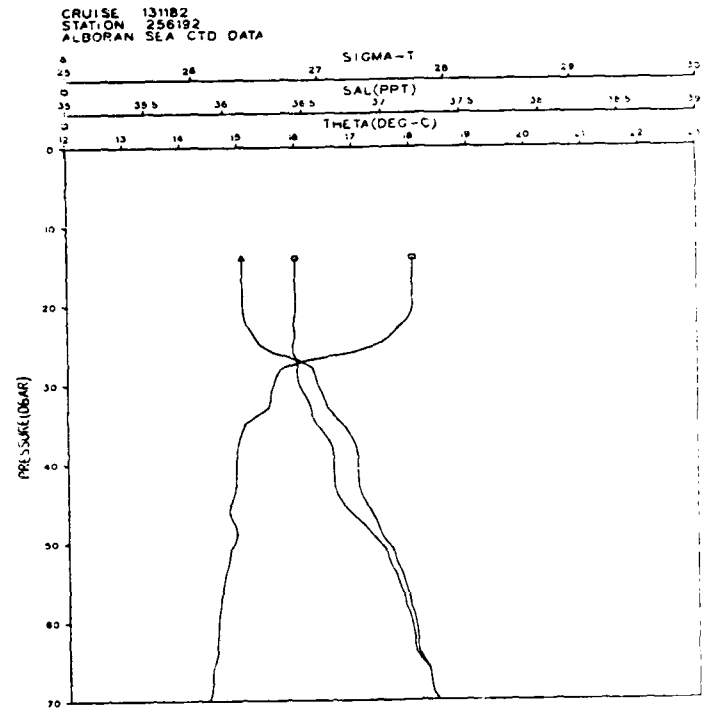

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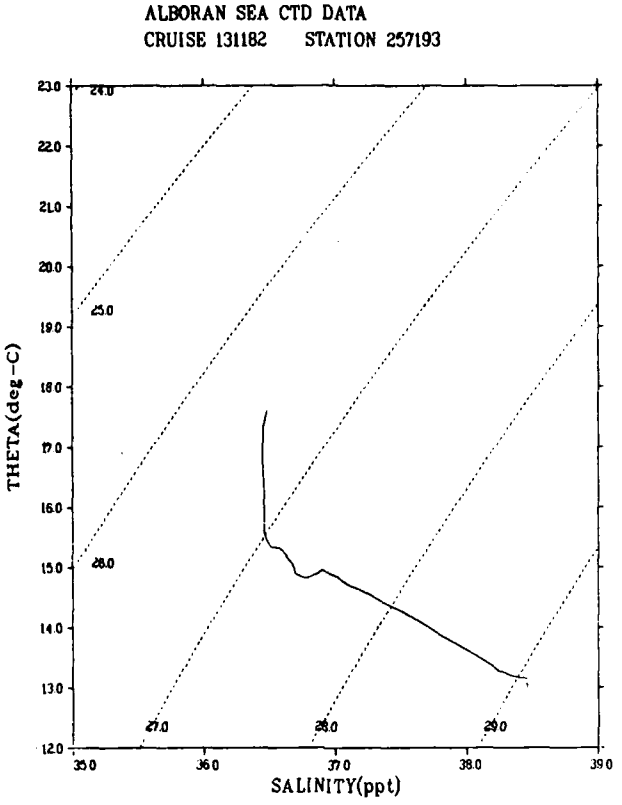

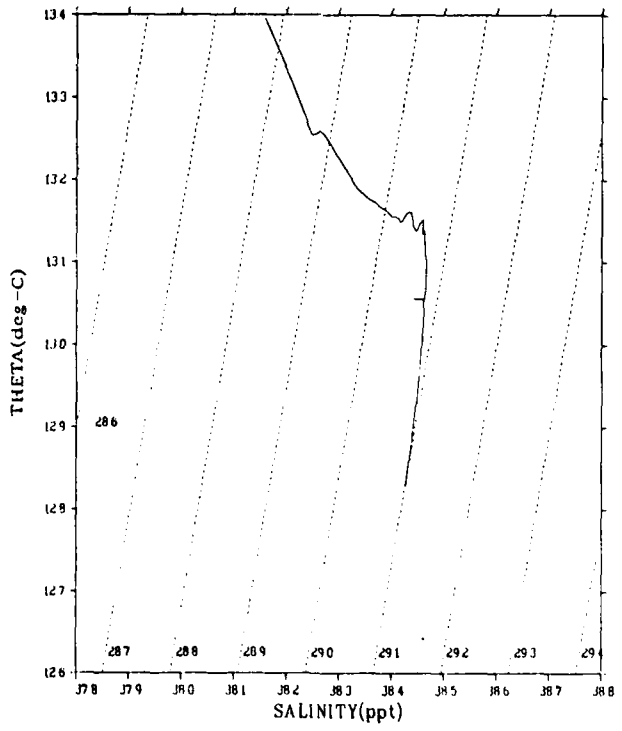

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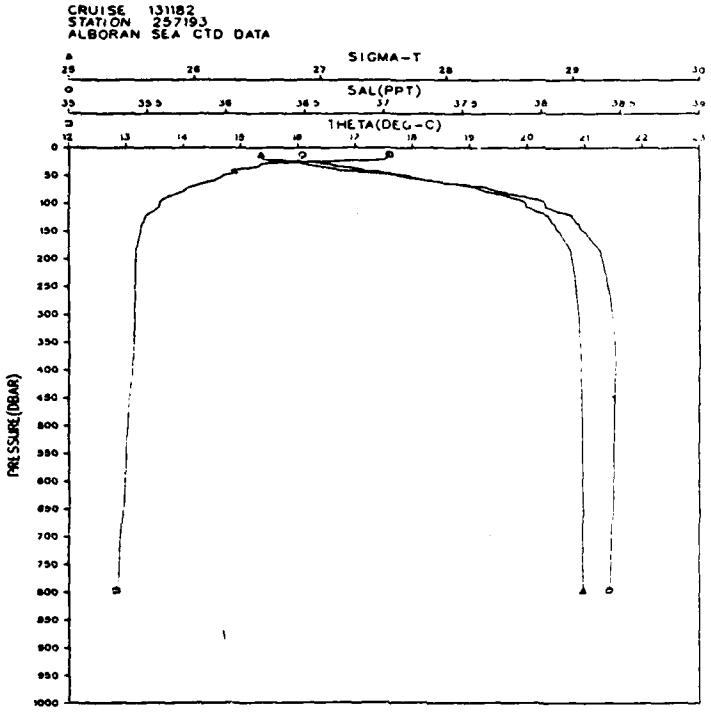

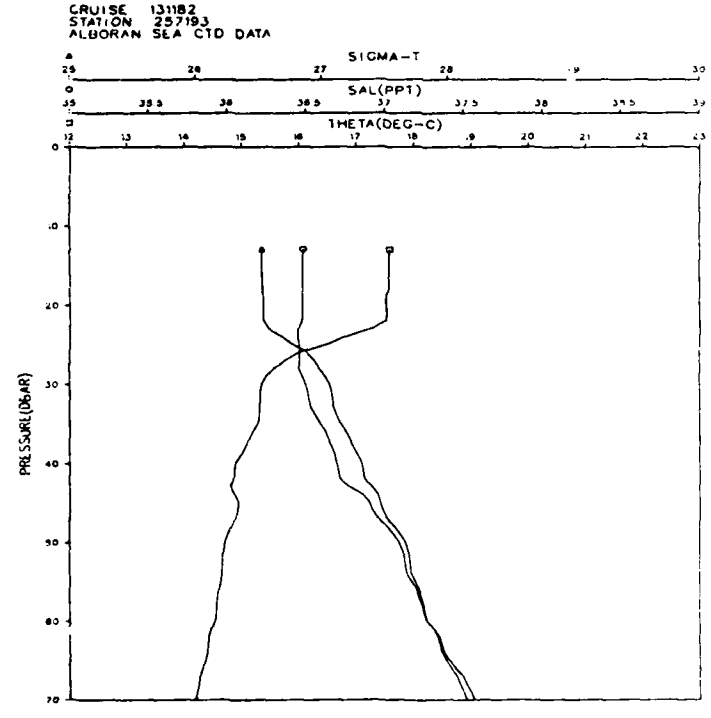

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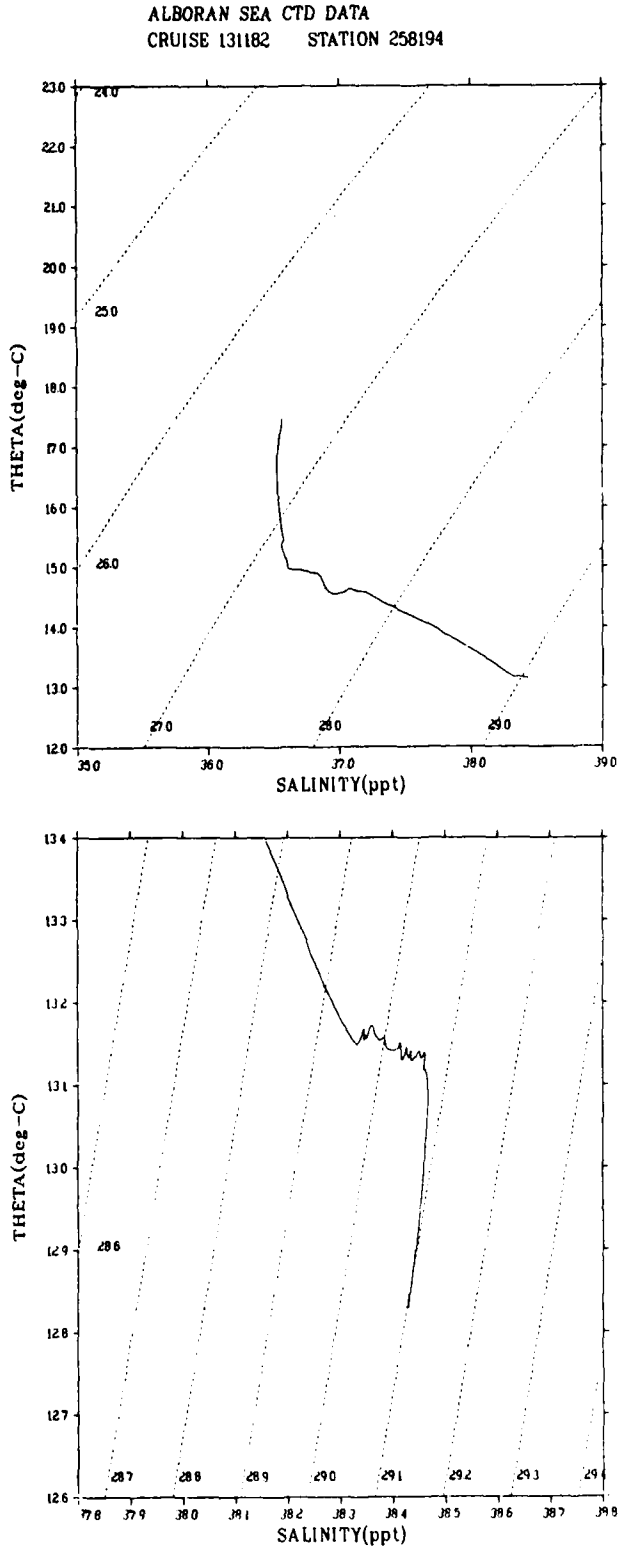

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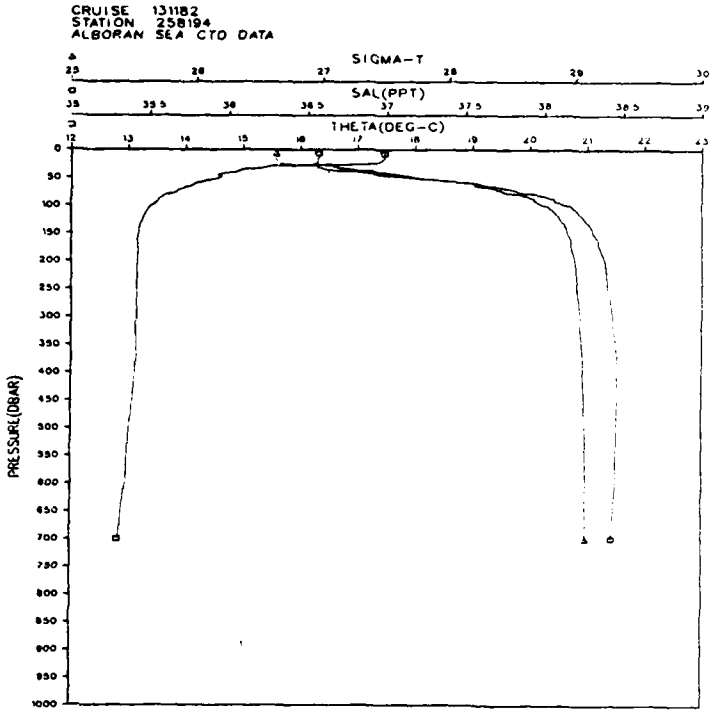

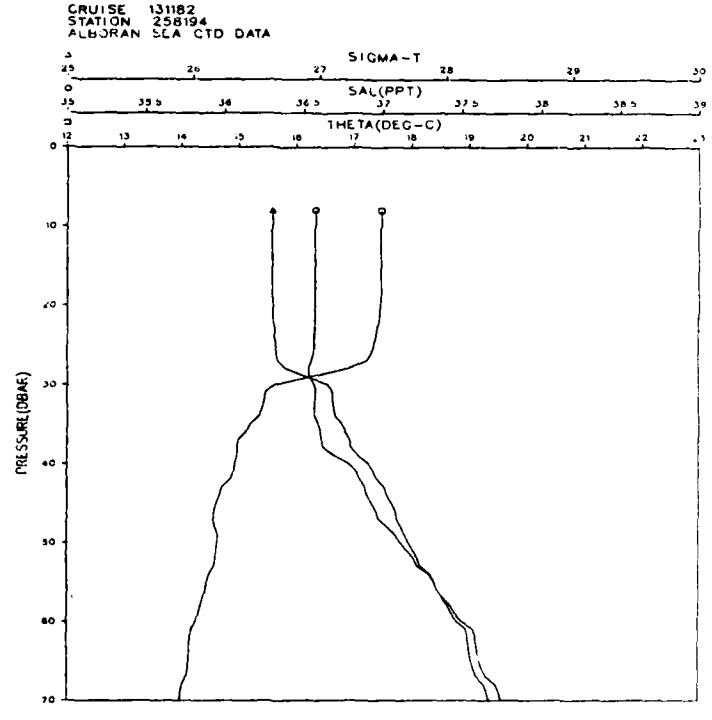

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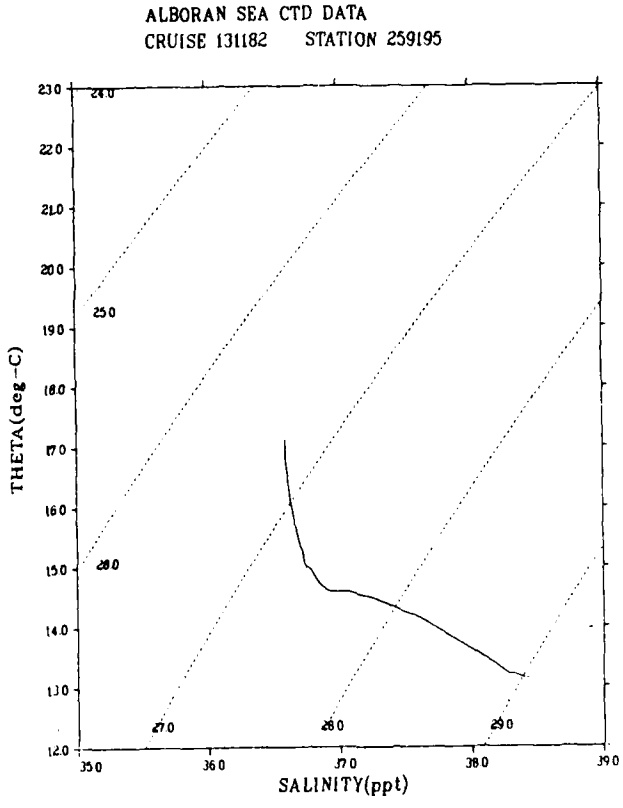

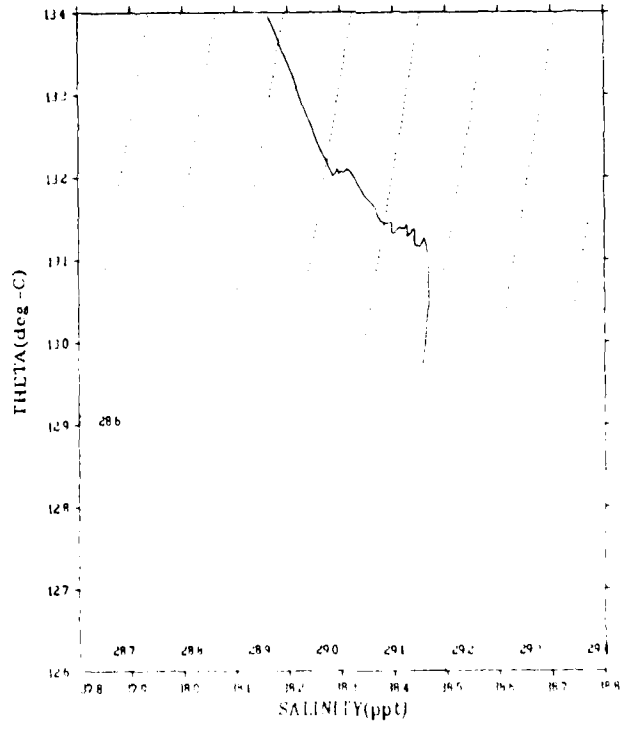

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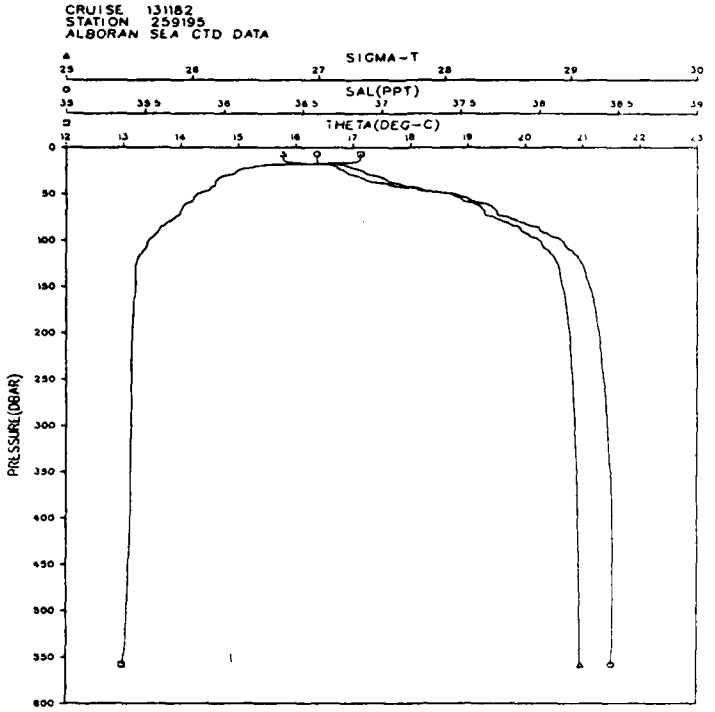

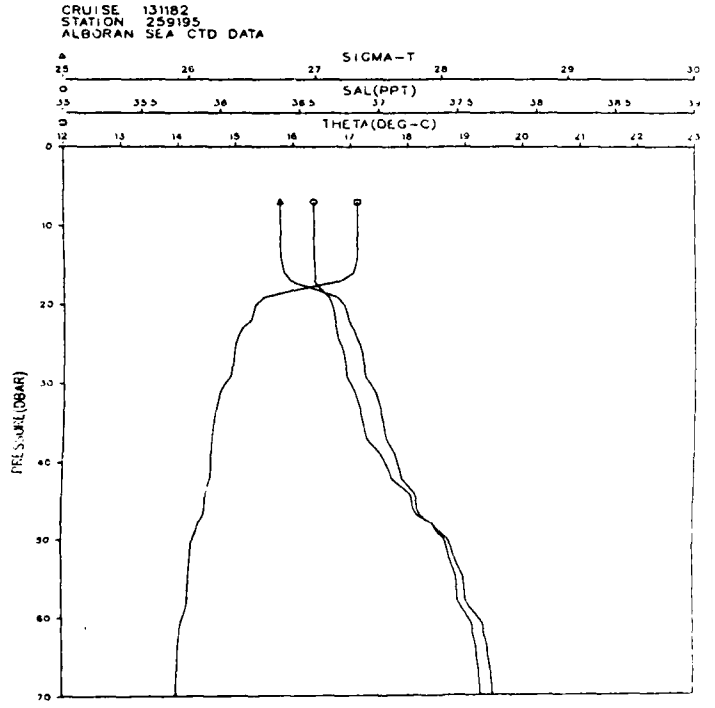

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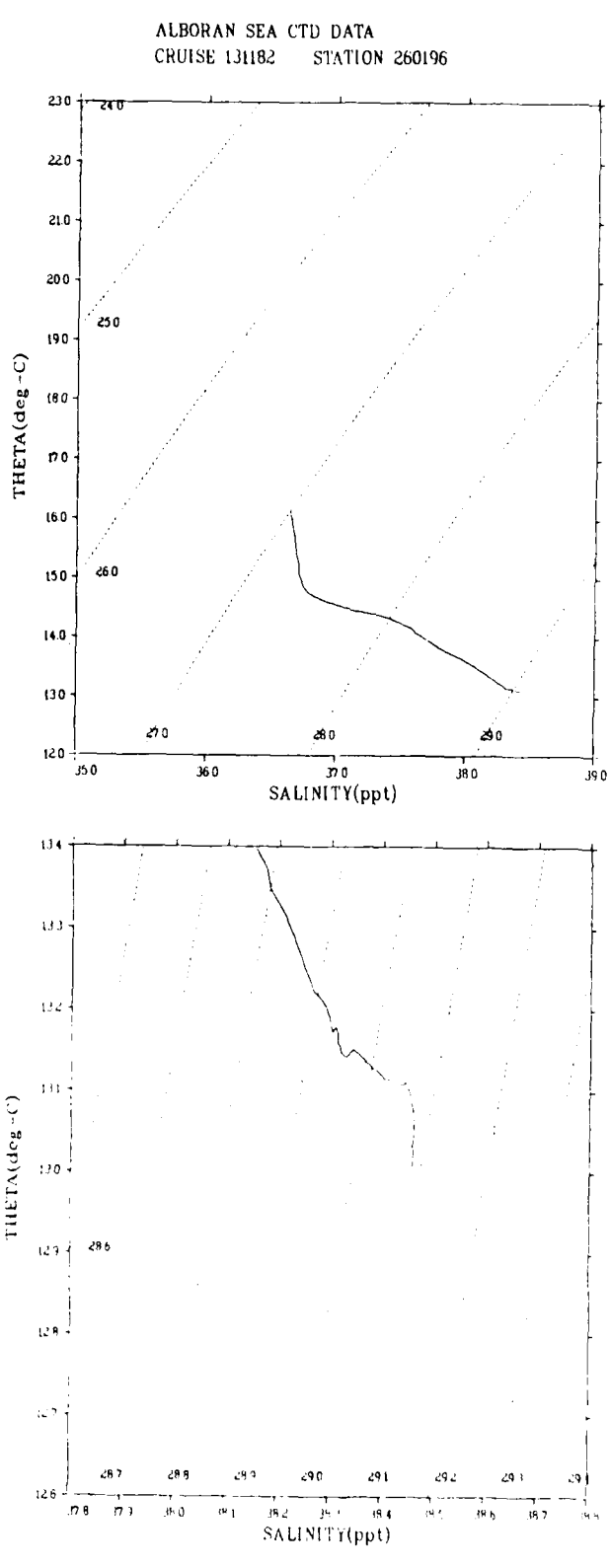

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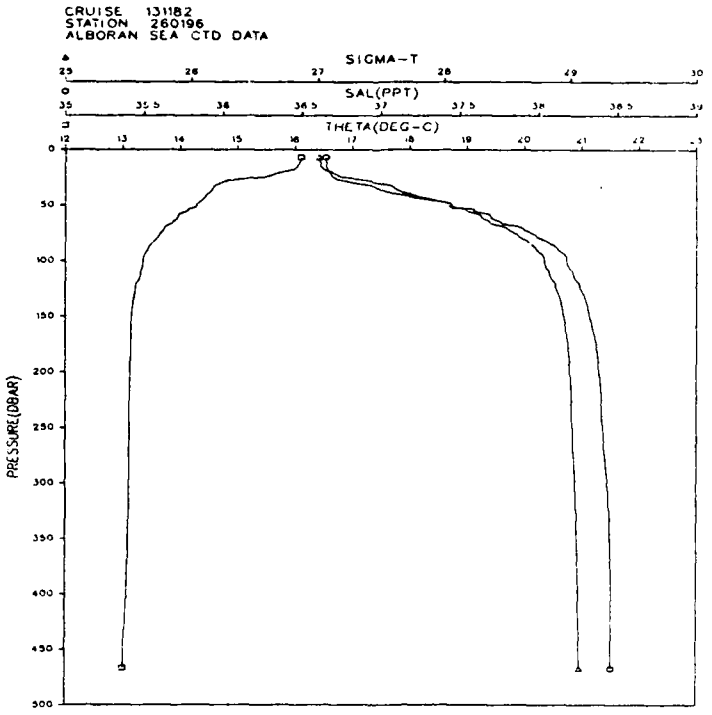

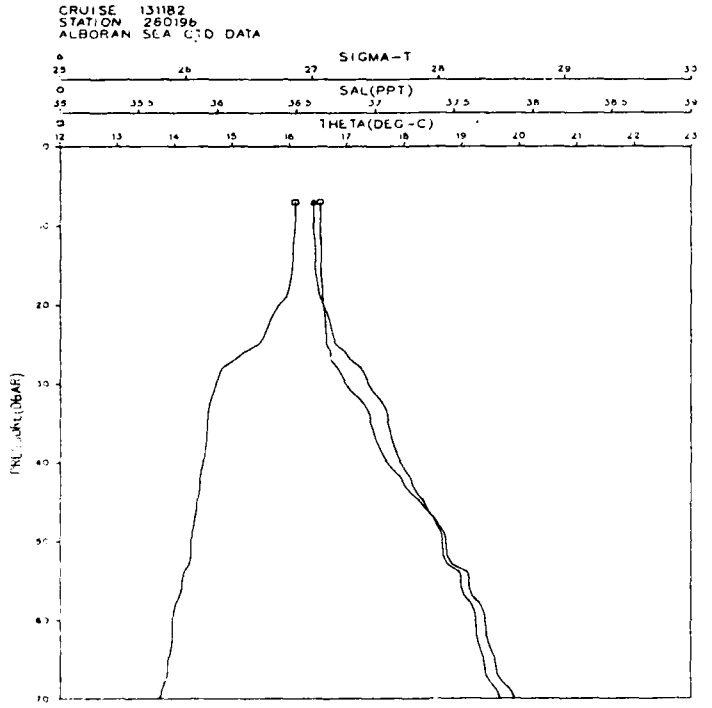

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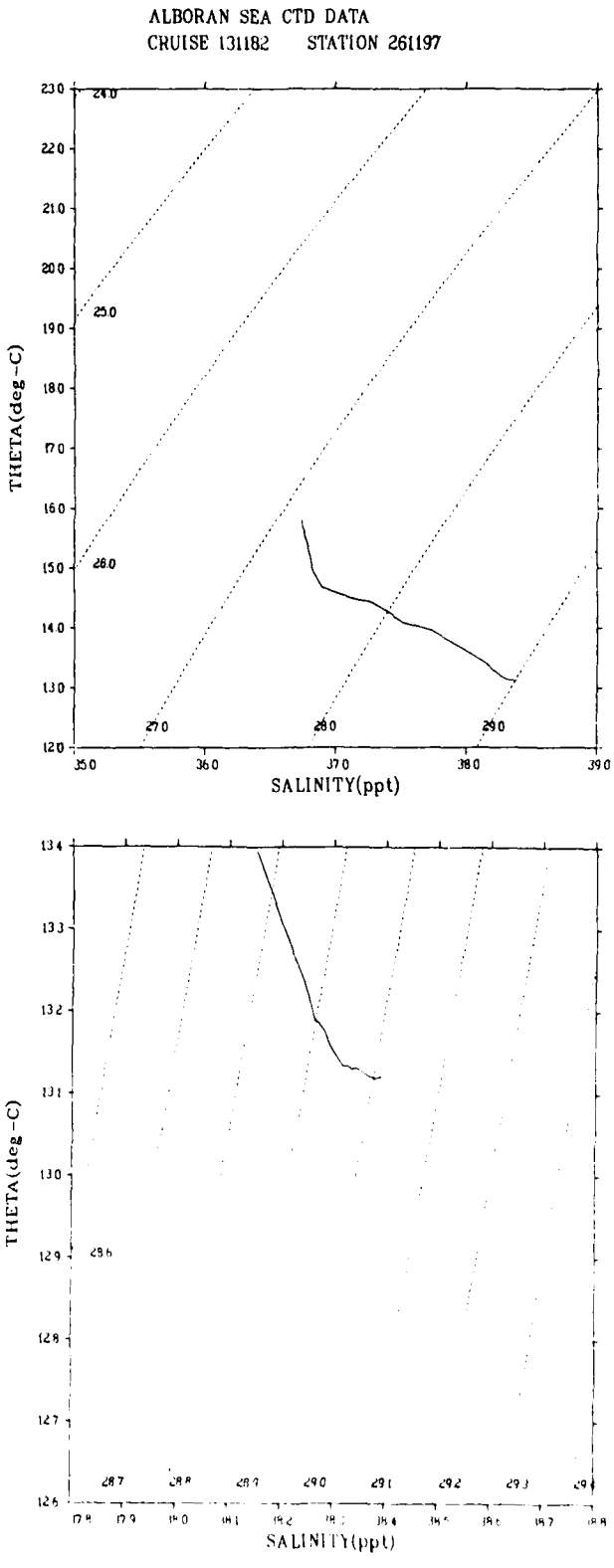

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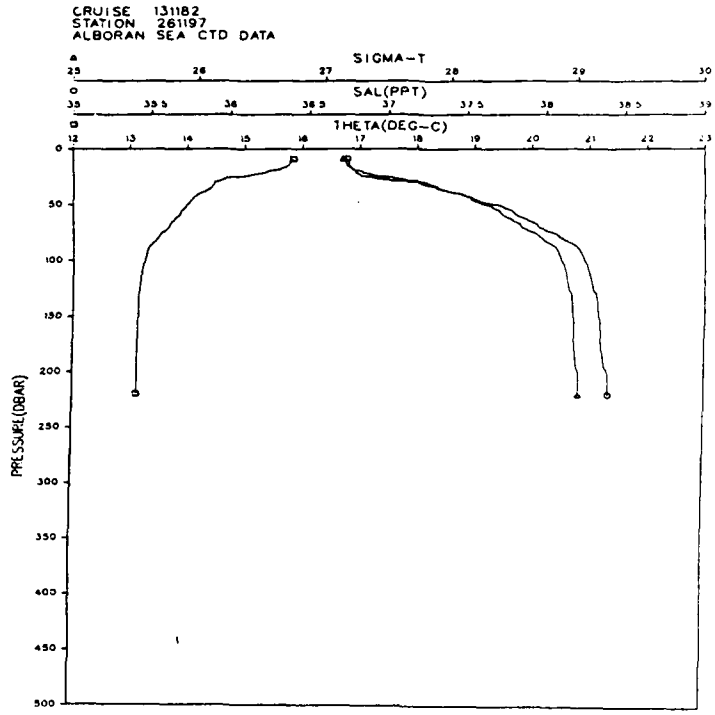

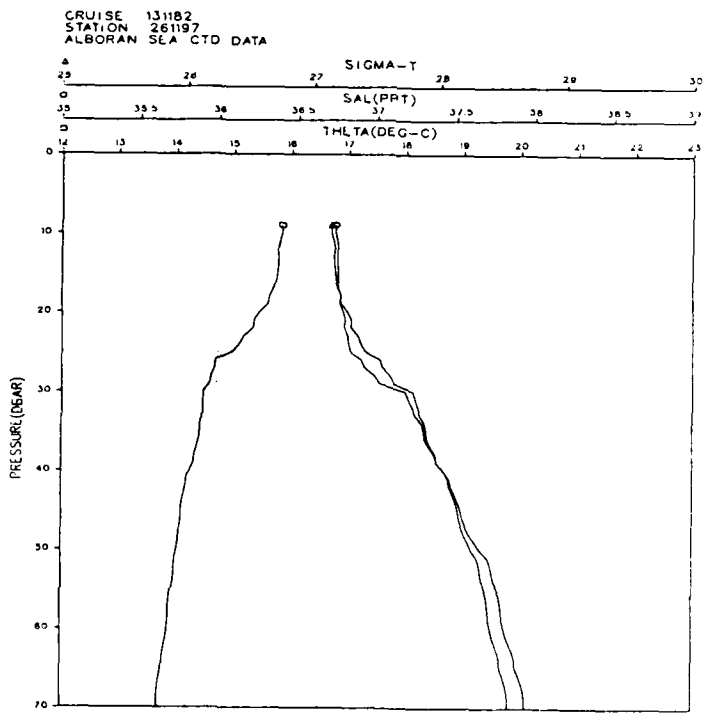

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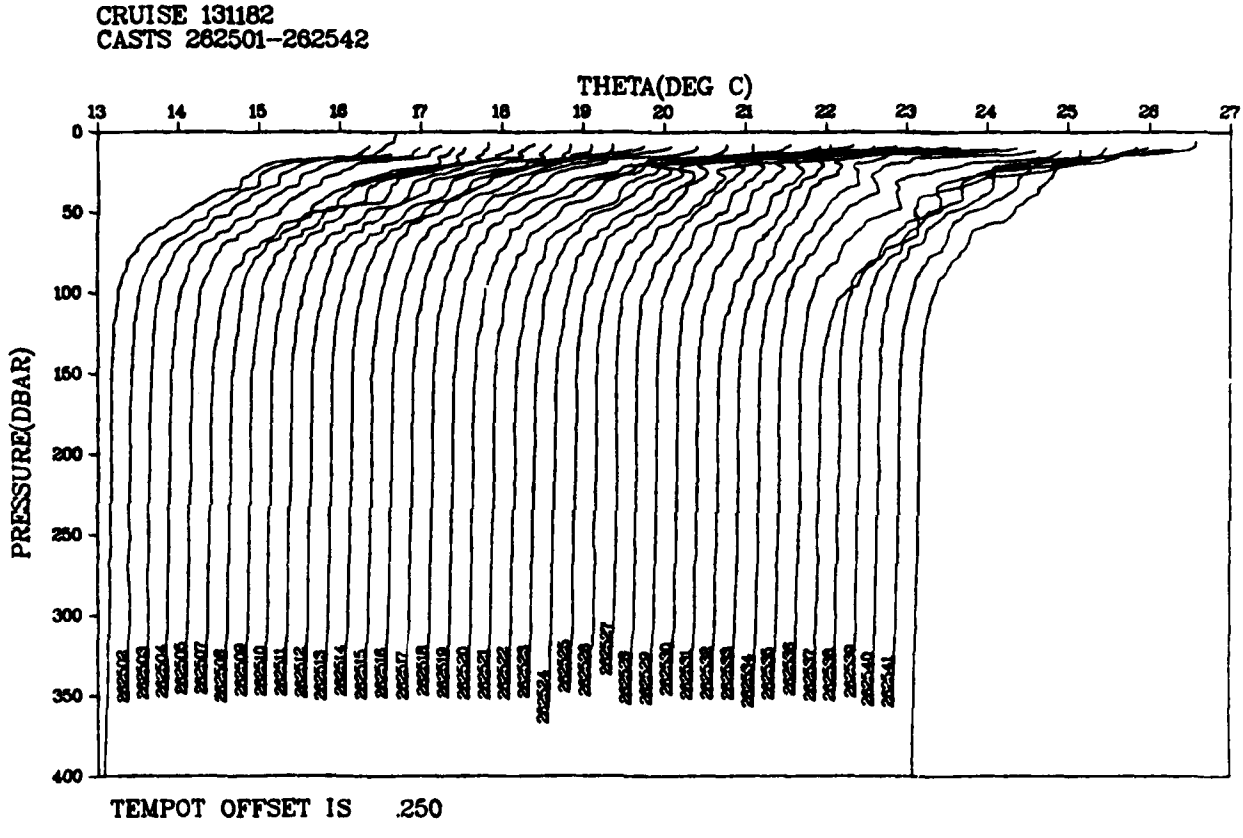

Figure 70a. Vertical temperature profiles

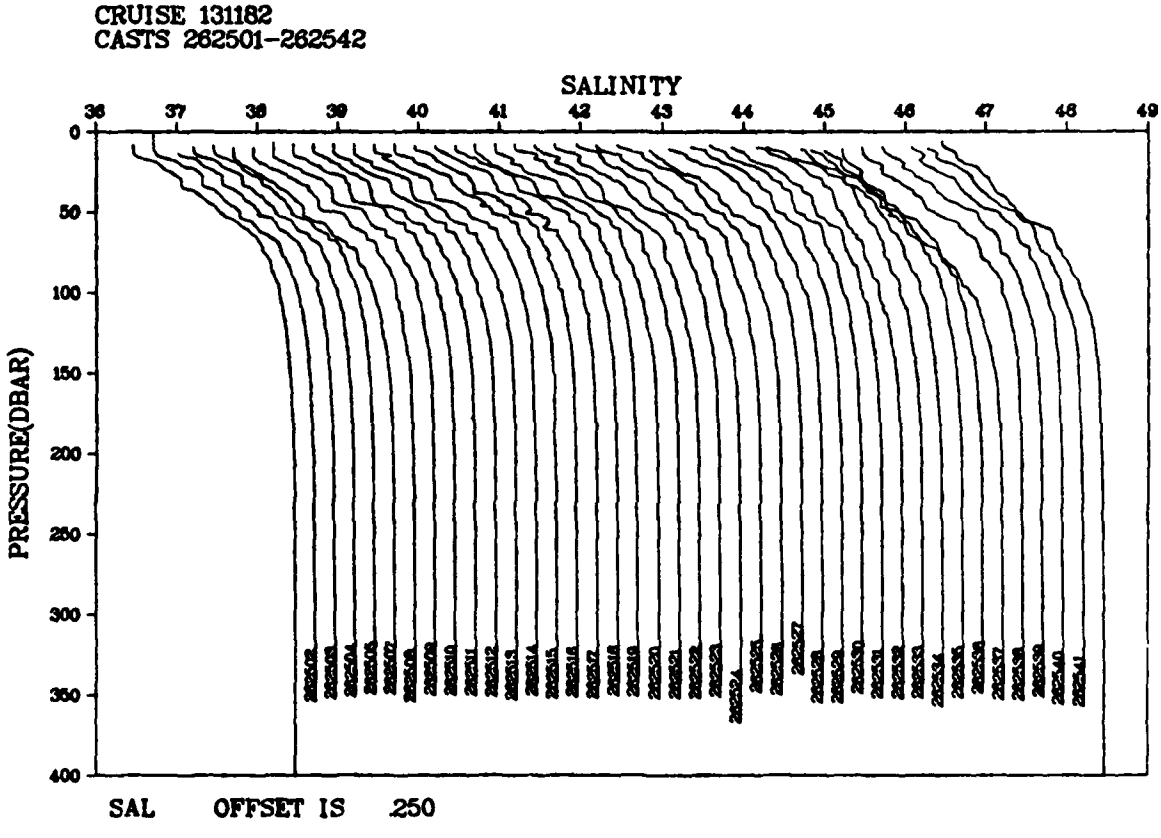

Figure 70b. Vertical salinity profiles

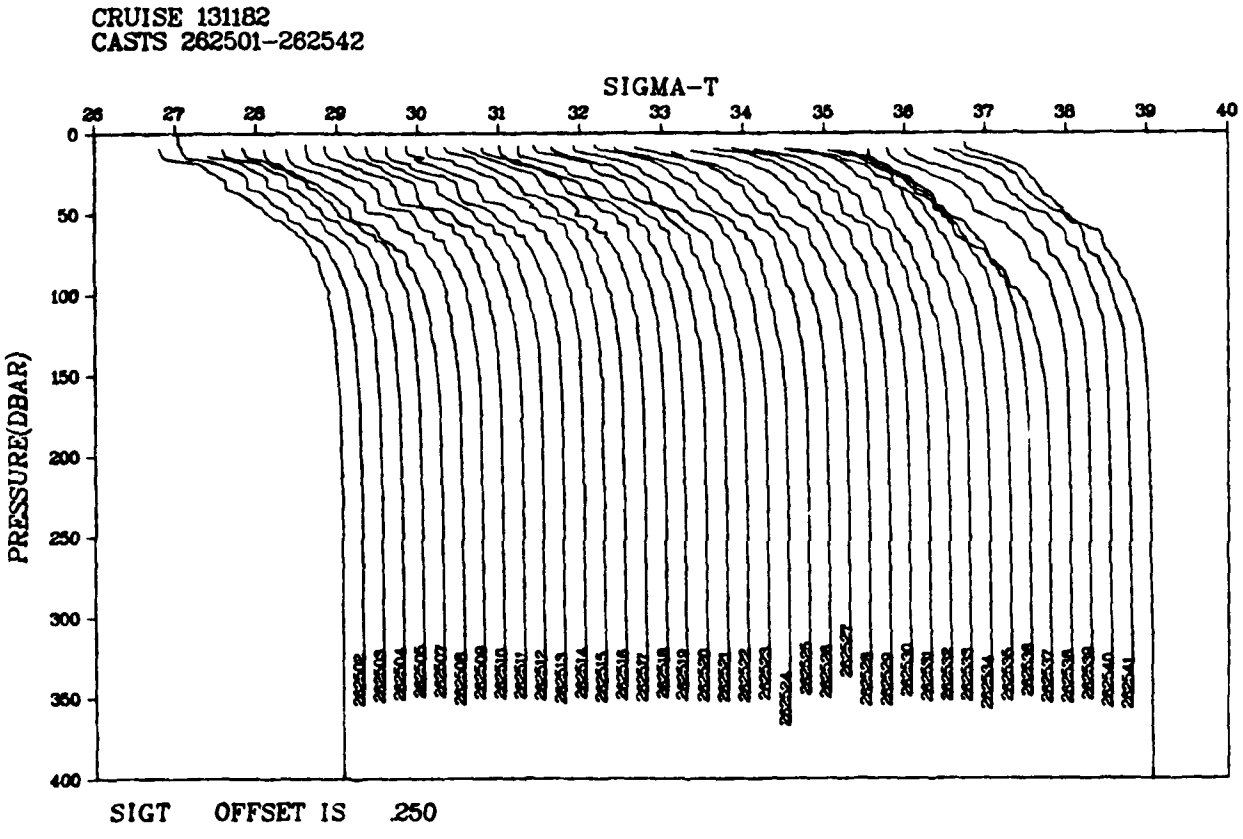

Figure 70c. Vertical density (sigma-theta) profiles

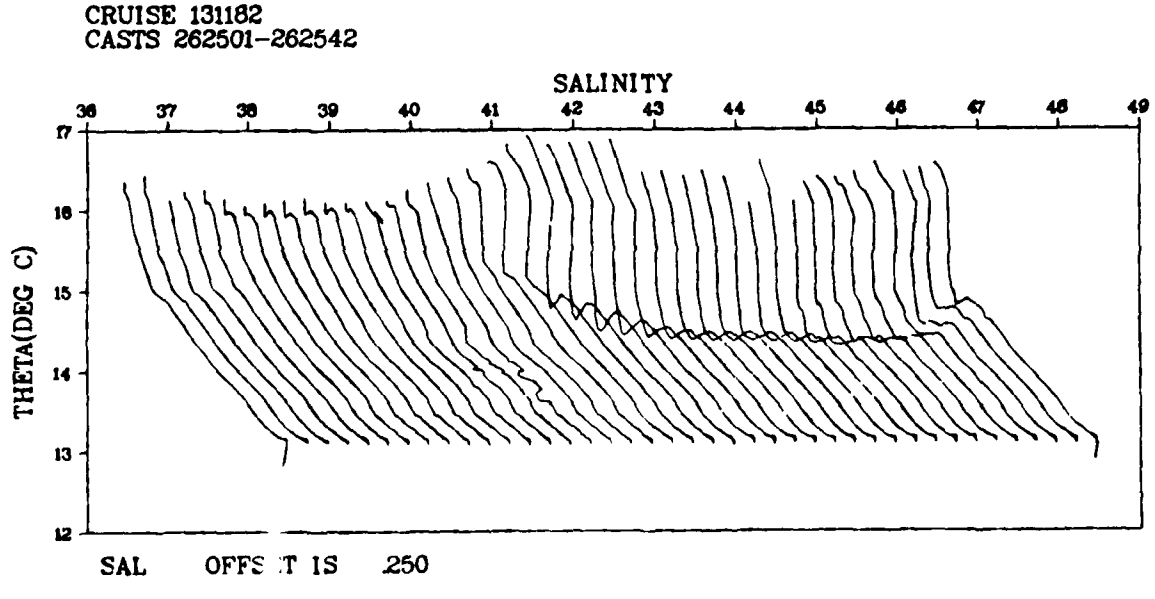

Figure 70d. Potential temperature-salinity diagrams

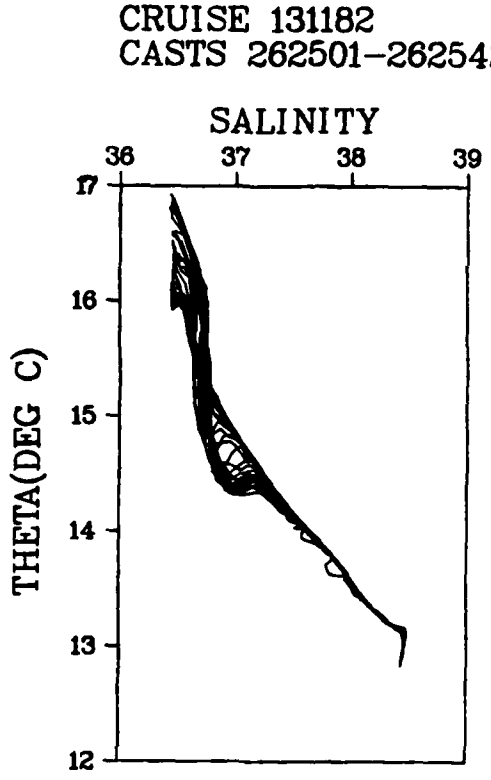

Figure 70e. Composite temperature-salinity diagram

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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

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Alboran Sea
Mediterranean Sea

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

During October 1982, 78 CTD stations were taken in the Western Alboran Sea (Western Mediterranean). Vertical profiles of potential temperature, salinity, and density are presented along with potential temperature versus salinity correlation diagrams. A comparison of CTD and water sample data is presented, and the rationale for a salinity correction is given.

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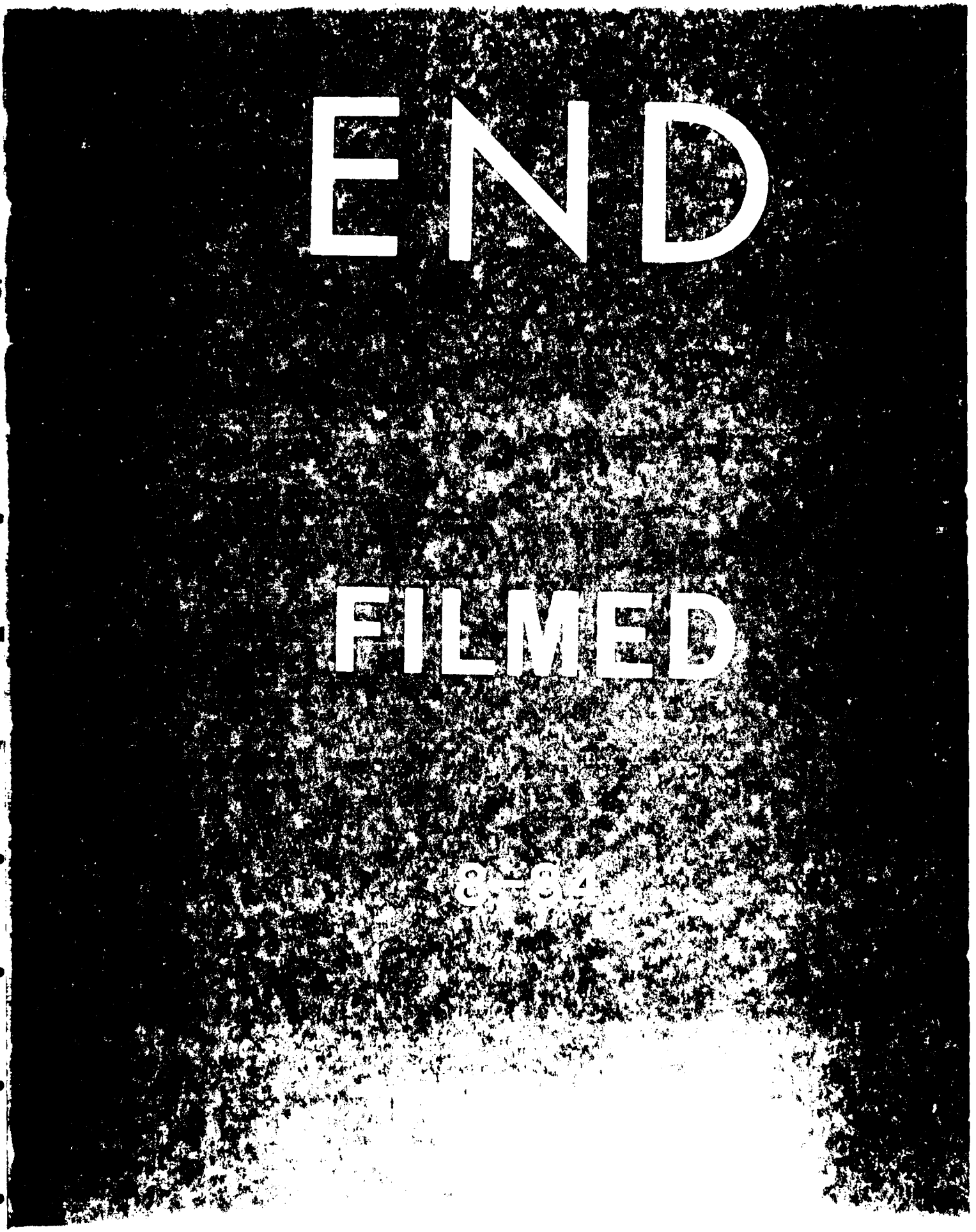
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